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RADIO & TELEVISION NEWS

DECEMBER
1956
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IN THIS ISSUE

KEY TO COLOR TV INSTALLATION AND SERVICING
(Test Patterns in Full Color)

ELECTRONIC AIDS FOR SMALL AIRCRAFT

LISTENING TESTS FOR SPEAKERS

DON'T BE AFRAID OF COLOR TV

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LEARN TO SERVICE ALL COLOR SETS

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COVER STORY
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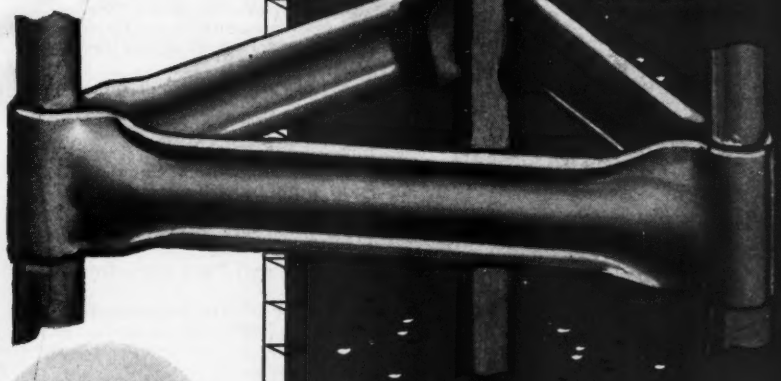

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COVER PHOTO: Probably the No. 1 gift on Santa's list this year is a color TV receiver, like this RCA "Aldrich" model being received with such enthusiasm. Heavy programming is expected to stimulate color TV sales. (Ektachrome by Chas. P. Mills & Son)

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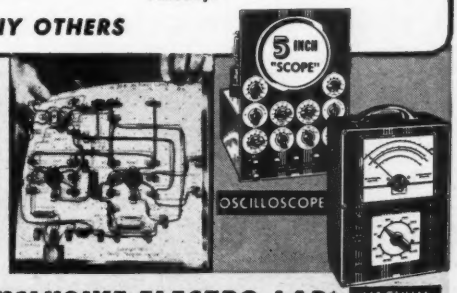

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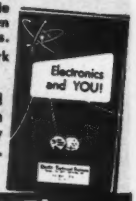

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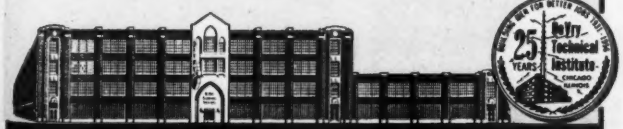

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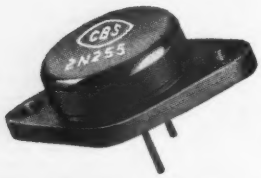

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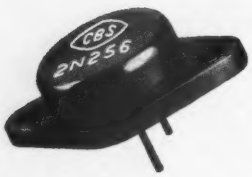

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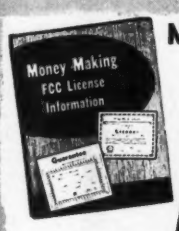

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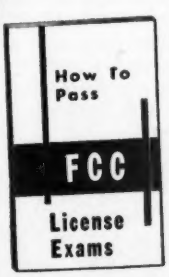

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For the RECORD

FACTORY TV SERVICE

WE HAVE received a great deal of correspondence of late dealing with the pros and cons of factory TV service plans. The average independent service technician states in no uncertain terms that factory TV service will rob him of his present customers and, in some cases, will ruin his business. Others question the wisdom of factory TV service, feeling that there will be long delays from the time a customer reports his troubles to the time when such factory technicians might show up at the customer's home. Still others fear that the manufacturers will sell components to their selected group of technicians at lower cost than to the independents.

No one can foretell, at least at this writing, as to how far the manufacturer will go in spreading his web of TV service. Some feel that the set makers will confine their operations to the large cities from which they have received the bulk of consumer complaints. Others feel that factory TV service will be limited somewhat to a regional operation; and still others feel that if such service procedures are profitable to the manufacturer, eventually all sets made by a particular company will be serviced directly through its own facilities.

Factory service is not new. The *RCA Service Company,* for example, has been operating successfully for many years. Other factory service departments are in the making or have already begun operations. We have repeatedly asked the question as to where the manufacturer would go for his technical talent and have received several entirely different answers.

The majority of set makers apparently will attempt to use established independent technicians or service dealers. Most of these dealers carry several different brands of TV sets. It would appear, then, that if each manufacturer attempts to woo a technician, specializing in several different makes, eventually there would result a situation leading to piracy. Available technicians then would find themselves in the position where they would actually have to either continue to be wholly independent or to join forces with a particular manufacturer.

It's a ticklish and somewhat complex situation, and after discussing the pros and cons of factory TV service with service executives of the companies there is little doubt that their intentions to go ahead are very real.

The consensus of the set manufacturers is that they have been literally forced to take over TV service as a "protection for their customers." They claim that with the wide acceptance of color TV, they would risk the future of their products if they relied upon "non-factory trained" personnel to maintain their receivers. They feel that their own technicians, being supplied with essential test equipment and know-how, will, through special training, be able to serve the customer more promptly and with replacement parts and tubes of their own make which would not otherwise be assured.

Most of the industry leaders have high praise for TV service technicians throughout the country. Only recently Mr. Frank Folsom, president of *RCA,* declared: "There can be no doubt that one of the most important contributions to the tremendous growth of television in the past ten years has been the high quality of work being performed every day by the nation's television service technicians." Mr. Folsom also added: "We are proud to pass along all the color experience of the *RCA Service Company* team to the thousands of independent servicemen and organizations who will service an overwhelming majority of the new color sets."

Other industry leaders have not been so complimentary in their remarks. In talking with them we learned that the feeling runs high in favor of factory service which will serve, they claim, as an aid in maintaining good customer relations. Others feel that direct control of factory-made components will provide better service; and while we doubt that the average technician would agree with this philosophy, nevertheless there can be no question as to their future objectives.

We have personally had the opportunity to check both so-called factory distributor service, as well as independent TV service—neither of the two has shown any particular advantage over the other.

In the former case, there were repeated delays, after the set was reported out of order, before a technician showed up to perform his duties. There was also an occasion where a technician came to service a color set without any of the essential test equipment required.

On the other hand, an independent diagnosed high-voltage failure as being due to a "burned-out transformer." Actually it amounted to nothing more than a faulty 2-watt resistor.

We cannot tell at this time whether or not "factory TV service" will be compatible or an improvement over existing techniques, but we have no reason whatsoever to believe that any serious threat exists for the progressive independent service technician who is well established and operates his business as a professional. . O. R.

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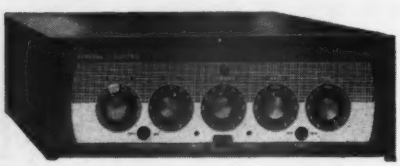

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20-watt Amplifier and Pre-Amp

Dual chassis design for independent installation or use as a complete unit. This flexible, low-cost component provides 7 panel-mounted controls. **$99.95**

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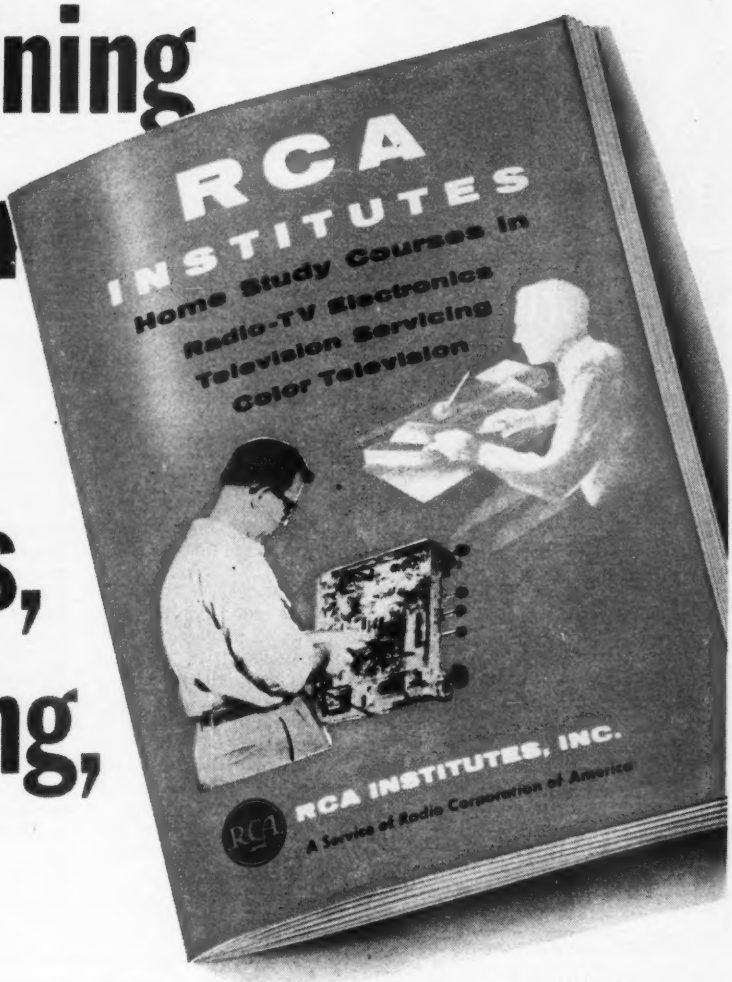

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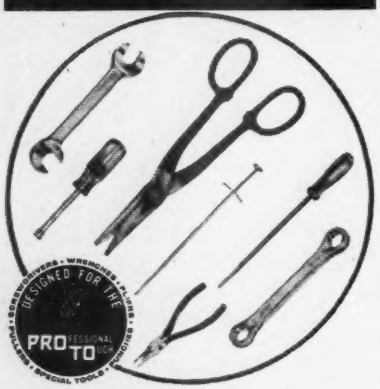

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Spot Radio News

*** Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE ALL-U.H.F. SHIFT, suggested by the FCC, has run into a storm of criticism in Washington, one equipment maker saying that such a move would be ". . . most injurious to the public interest . . ." and could ". . . jeopardize the whole future of television broadcasting in the United States."

However, it was stressed, u.h.f. must not be buried. "It is of greatest importance to the future of TV broadcasting," the Commission was told, "that u.h.f. television be encouraged now; that it not be left exposed to the possibility of withering in a state of suspended animation pending resolution at some future time of additional aspects of its operation. . . . The present obstacles to fully effective utilization of the u.h.f. channels do not lie primarily in failure to solve technical problems: These problems have arisen principally from problems of economics and circulation."

The differences between the ultra-highs and the very-highs, the comment to the Commission added, arise ". . . primarily from conditions of nature. These differences are such that the service provided by v.h.f. TV in areas of mountainous terrain and cities with large man-made structures will normally continue to be superior to that provided by u.h.f."

The ultra-highs, members of the FCC were told, can furnish a highly ". . . satisfactory service to the public provided allocations are made to take these factors into account. But v.h.f. should continue to be assigned to areas where use of the u.h.f. band would impair service to the public."

CALLING THE ALL-U plan a radical one, one broadcaster declared that there are too many vital questions to be answered before anyone can determine if the shift is a proper one; the move, it was noted, could entail too high a price in terms of service and cost to the public.

It will be necessary, the broadcaster added, to ". . . explore whether or not statistical data from field-intensity measurements of u.h.f. stations can properly take variables (actual service ranges of u.h.f. and v.h.f. under varied conditions) into consideration . . . since it is difficult to take average projected conditions and know if they would be . . . singularly applicable in specific circumstances."

The Association of Federal Communications Consulting Engineers also told the Commission that it found fault with the all-U idea. The u.h.f. formulas offered by the FCC's engineers were described as over-simplified; they cannot be used to gauge loss or gain of population. In addition, it was said, the departures from the averages are so great on the high bands,

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Florida	Jacksonville	WFGA-TV	12	204-210	316
Indiana	Roanoke	WPTA	21	512-518	251
Louisiana	New Orleans	———	32	578-584	229
Oregon	Coos Bay	———	16	482-488	20.5
South Dakota	Aberdeen	KDHS	9	186-192	1.58
Texas	Alpine	———	12	204-210	.59
Wyoming	Riverton	———	10	192-198	64

NEW CALL LETTER ASSIGNMENTS

Connecticut	Hartford	WHCT Formerly WGTH-TV	18	494-500
New York	Rochester	WROC-TV Formerly WHAM-TV	5	76-82
Tennessee	Knoxville	WATE-TV	6	82-88

*ERP=(effective radiated power, kw.)

GET IN ON THE TV BOOM!

L. C. Lane, B.S., M.A. President, Radio-Television Training Association. Executive Director, Pierce School of Radio & Television.

TRAIN FOR A TOP-PAY JOB AS A TELEVISION TECHNICIAN

NO PREVIOUS EXPERIENCE NEEDED — study AT HOME in your SPARE TIME

Next to the atom and hydrogen bombs, the biggest noise being made today is by the booming radio-television-electronics industry.

***Now,* while the boom is on in full force, is the time for you to think about how you can share in the high pay and good job security that this ever-expanding field offers to trained technicians.**

Just figure it out for yourself. There are more than 400 television broadcasting stations operating right now and hundreds more to be built; more than 34 million sets in the country and sales increasing daily. Soon moderately priced color television sets will be on the market and the color stampede will be on.

All these facts mean that good jobs will be looking for good men. You can be one of those men if you take advantage of my training *now* — the same training that has already prepared hundreds of men for successful careers in the radio-television-electronics field.

No experience necessary! You learn by practicing with professional equipment I send you. Many of my graduates who now hold down good paying technician jobs started with only grammar school training.

If you have previous Armed Forces or civilian radio experience you can finish your training several months earlier by taking my FM-TV Technician Course. Train at home with kits of parts, plus equipment to build YOUR OWN TV RECEIVER. ALL FURNISHED AT NO EXTRA COST!

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FM-TV TECHNICIAN TRAINING

Sylvania Now Sponsoring RTTA's Color TV Technician Course

One of the nation's largest electronics manufacturers and marketers Sylvania Electric Products Inc. in its continuing effort to cooperate with independent service dealers is now sponsoring the RTTA Color Television Technician Course. Available to Authorized Sylvania Dealers.

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EARN WHILE YOU LEARN Almost from the very start you can earn extra money while learning by repairing radio-TV sets for friends and neighbors. Many of my students earn enough each week to pay for their entire training from spare time earnings . . . start their own profitable service business.

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SONOTONE HFA-150

15-WATT POWER AT A 10-WATT PRICE!

No amplifier on the market today can compare with the all-new Sonotone HFA-150. Full 15-watt power—superb sound—plus more new, useful "firsts" than any other amplifier at any price.

ONLY 3" HIGH—12" WIDE! For the first time, a complete power *and* control amplifier this compact...without an iota of performance being sacrificed to compactness. The ultra-smart cabinet cover is available in a *choice* of colors—another Sonotone first!

SIX INPUTS! For the first time, a quality amplifier in this price range that gives you single switch choice of 6 inputs. Three of these inputs have *individual pre-set level controls!*

SEPARATE CONTOUR CONTROL! For the first time you get new, exclusive push-pull rumble and noise filters. Bass, treble and volume controls with a *separate* continuous contour control, infinitely variable from flat to 26 db of contour compensation.

The Sonotone HFA-150 is, unquestionably, the greatest value in *fine* high fidelity components in many years. Make seeing and hearing it a "must"!

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due to terrain and miscellaneous factors, that average curves cannot be used in connection with measurements made at u.h.f. Actual tests on operating stations are necessary to arrive at plausible conclusions, the engineers reported to the Commission.

THE SIZZLING BOOSTER STATION issue, raised by Governor Ed Johnson, when he *authorized* a booster to continue operating (and since that approval many others have also begun operating with his blessing) even though the FCC said such operation was illegal, is still up in the air.

Commenting on his move, the Governor told one of the Commissioners that the approved translator system was ". . . splendid for the Atlantic Seaboard, but it is not necessary in the Rocky Mountains." Stations in the west, the Colorado chief said, were ". . . thousands of miles apart . . ." and they were separated by mountains.

Asking the Washington authorities ". . . What is wrong with two systems in this big United States?", the former chairman of the Senate Commerce Committee went on to tell the FCC that ". . . just because you have found something that fits the area with which you are familiar, please don't force it down our throats arbitrarily."

The fiery legislator also tore into the Commission for taking no action against the community TV stations, but going ". . . out of its way to clap the booster system down.

"Why," he asked the FCC, "are you picking on us mountain folks? We are people, too."

DEVELOPMENT OF HIGHER POWER transmitting tubes to permit the Air Force to contact aircraft higher and farther away than with present equipment has been announced by the Air Research and Development Command.

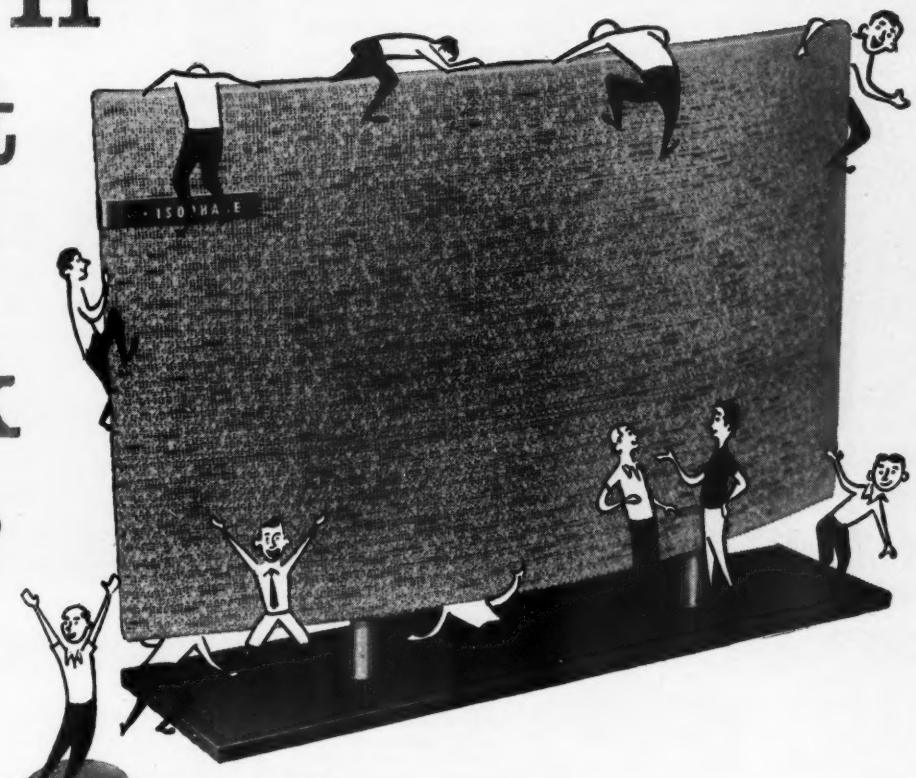
In one case, the new tubes have been used in a one-kilowatt u.h.f. amplifier to provide a ten-fold increase in ground-to-air communication transmitting power. The power was chosen to afford the most efficient range, with the least interference, and at the lowest cost level. The modulator portion, it was said, operates at a distortion level less than three-fourths of one per-cent, which is unusually low for equipment of this type.

The entire amplifier unit weighs less than a ton and is composed of preamplifier and remote control, radio-frequency amplifier, power supply, cooling, power control, and modulator units. The amplifier was described as multi-purpose in design and function; its communication facilities can be permanent or mobile and can transmit voice or data signals.

The importance of this equipment can also be evaluated in terms of increased safety for Air Force personnel. In the past, aircraft often were lost only because they were beyond the range of radio contact. With the increased power provided by this new

(*Continued on page* 132)

you'll want to look for the Orchestra



When your authorized Pickering Dealer is demonstrating the revolutionary new ISOPHASE SPEAKER, please, don't look behind it for the orchestra. Take our word for it—these magnificently realistic sounds are coming from the curved diaphragm itself. "Unbelievable," "extraordinary," "breathtaking," and "window-on-the-studio quality" are some of the comments we've heard from dealers and customers alike. But don't be persuaded by mere words alone. *Hear it for yourself.*

The Pickering ISOPHASE SPEAKER uses the electrostatic principle to recreate musical sounds with a degree of realism unattainable in conventional speakers.

The ISOPHASE reintroduces the original sound into the air *at a low velocity*—instead of at a high velocity as in ordinary speakers. In addition, the ISOPHASE generates sound in phase *from the entire surface* of its large curved diaphragm—instead of from a point source as in conventional cone speakers. Thus the sound reproduced by the ISOPHASE *closely approximates the unit-area energy of the original sound* entering the microphone in the studio or concert hall.

Unlike ordinary speakers, the ISOPHASE does not "break up" at high frequencies. And because of the inherent linearity of the push-pull electrostatic design, harmonic and intermodulation distortion are virtually nonexistent—a tremendous advantage over conventional speakers. For further details, please write Department C-13.

PICKERING & CO., INC. OCEANSIDE, N. Y.

Professional Audio Components *"For those who can hear the difference"*

Demonstrated and sold by Leading Radio Parts Distributors everywhere. For the one nearest you and for detailed literature: write Dept. C-13

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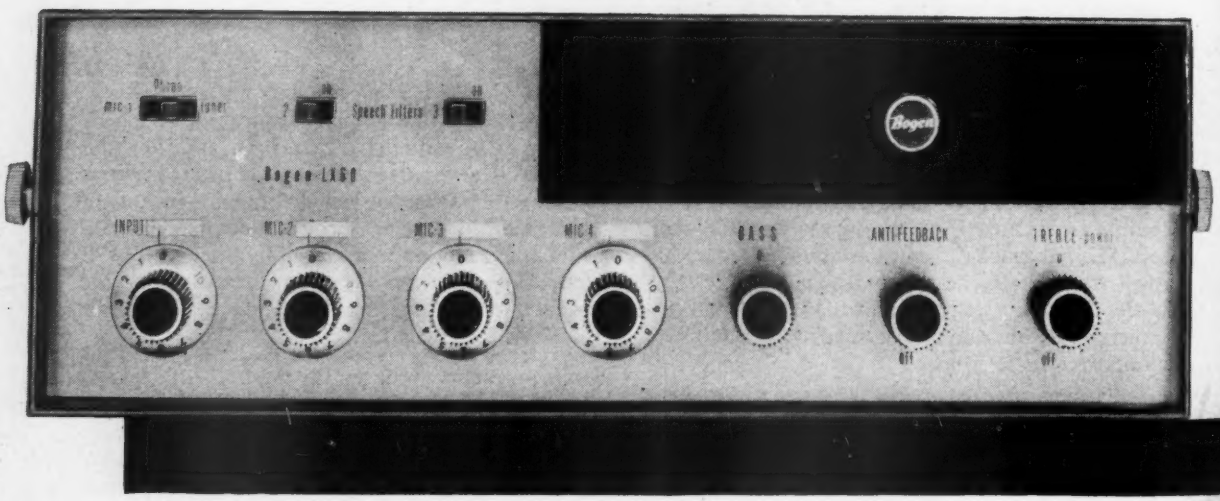
INTRODUCING BOGEN FLEX-PAK®*

*custom flexibility in packaged PA

EASIEST-TO-INSTALL, EASIEST-TO-SERVICE

portable or permanent . . . make more sales, more profits



NEVER AGAIN need you miss a sale because your "packaged" PA equipment wasn't designed for a specific commercial installation—and your customer wouldn't stand still for an expensive custom design. Meet BOGEN's FLEX-PAK public address line. Here's true portability. Here's easy servicing. And here's all the flexibility, performance and dependability you'll need to satisfy 90% of your *commercial applications* – without going back to the manufacturer's "custom division" for expensive (i.e., hard-to-sell) special designs. And, thanks to FLEX-PAK design, your cost-conscious customer need buy only the equipment he needs – and you can see him later about additional features. (Note that record player mounts, locking panels, remote controls are all *separate accessories.*) You can offer these systems in every price range, at practically every popular wattage, in three handsome BOGEN FLEX-PAK series: LX, L and K.

(1) Get in touch with your BOGEN representative immediately, or (2) mail for all FLEX-PAK specifications and prices by checking the coupon on the facing page. NOTE: we also supply famous-make indoor and outdoor speakers, microphones and other accessories for all your BOGEN public address system installations.

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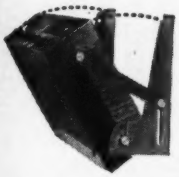
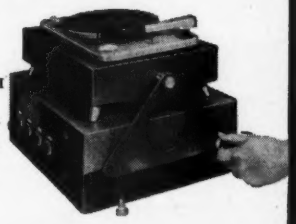
LOOSEN 4 THUMBSCREWS AND THE LID'S OFF for easy access for fast servicing.

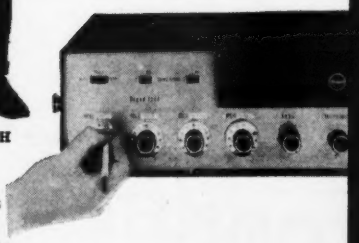


FOLDS BACK WHEN NOT IN USE in easy-sliding accessory wall-mount bracket.

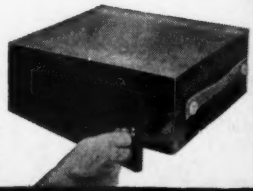


4 THUMBSCREWS ATTACH ACCESSORY RECORD PLAYER MOUNT. (Note: "cooling area" protects phono mechanism.)

BRIEFCASE PORTABILITY thanks to slim design, handy on-end carrying straps.



WRITE-IN ON EACH GAIN CONTROL prevents embarrassing mistakes in volume settings. (Easy to erase markings.)

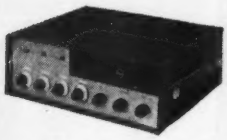


LOCKING PANEL (accessory) protects against tampering with settings. Covers entire control panel, not just on-off switch.

A BOGEN FLEX-PAK PA SYSTEM FOR EVERY USE...EVERY BUDGET

The amplifier-control units shown here are representative of more than twenty different models available to you—in all desired wattages; handsomely finished in dark gray with brushed aluminum face plate. Dealer net prices range from $45 to $155 for "full control" amplifiers.

DELUXE "LX" SERIES



LX30 30-WATTS

4 Microphone Inputs (panel switch converts one mike channel for phono or tuner)

Built-in Remote Gain-Control Circuit

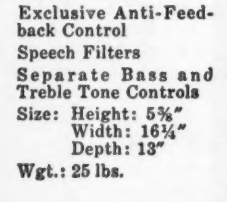
Exclusive Anti-Feedback Control

Speech Filters

Separate Bass and Treble Tone Controls

Size: Height: 5⅜" Width: 16¼" Depth: 13"

Wgt.: 25 lbs.



LX60 60-WATTS

with accessory LPA-4 4-speed Manual Phono

Except for slightly greater weight (29½ lbs. without phono) and added power, the LX60 has same features and controls as LX30 shown above.

LPA-3 (3-speed) or LPA-4 (4-speed) phono mount includes manual record player, pan, legs, end pieces, couplings for easy mounting.

SUPERB "L" SERIES

L330 30-WATTS

with accessory LPA-4 Manual Phono

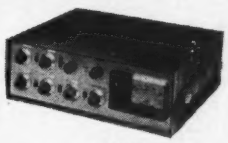
3 Microphone Inputs (panel switch converts one mike channel for phono or tuner)

Speech Filters

Separate Bass and Treble Tone Controls

Size: Height: 5⅜" Width: 14¼" Depth: 13"

Wgt.: 24 lbs. without phono



LOM PREAMPLIFIER CONTROL

5 Separate Microphone Gain Controls plus Master Gain Control.

1 Microphone channel converts to phono or tuner with selector switch on panel.

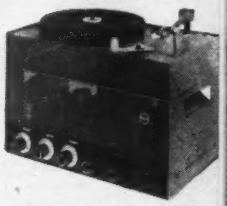
Illuminated Level (VU) Meter.

Separate Bass and Treble Tone Controls—plus Speech Filters for four microphone channels.

Size: Height: 5⅜" Width: 16¼" Depth: 11"

Wgt.: 20 lbs.

ECONOMICAL "K" SERIES



K130 30-WATTS

with accessory KPA-3 Manual Phono

1 Microphone Input

1 Phono Input

Speech Filter

Separate Bass and Treble Tone Controls

Size: Height: 6¼" Width: 14" Depth: 8"

Wgt.: 16 lbs. without phono

KO100 100-WATTS

Powerful line amplifier. Built especially for long-term, dependable performance with no service problems.

Size: Height: 7⅜" Width: 17⅜" Depth: 6½"

Wgt.: 28 lbs.

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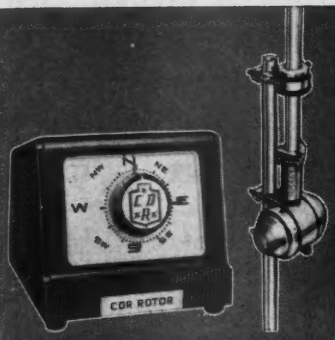
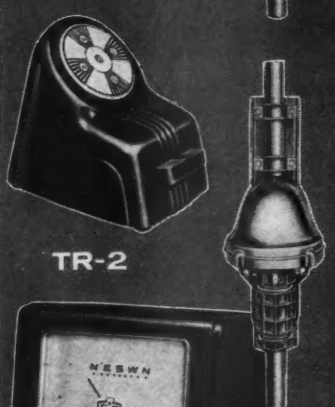
☐ *Please send me 24-page, illustrated brochure, "What You Should Know About Sound Systems."*

☐ *Please send me your 56-page, illustrated book, "Understanding High Fidelity," by L. H. Bogen and L. Biancolli. (I enclose 25c.)*

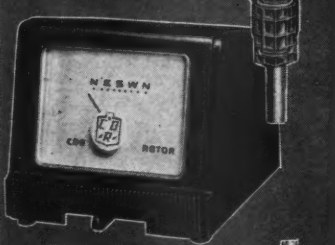


AR 1 and 2

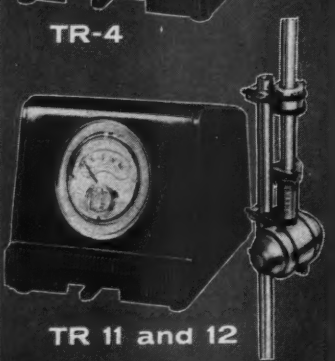
AR-22



TR-2



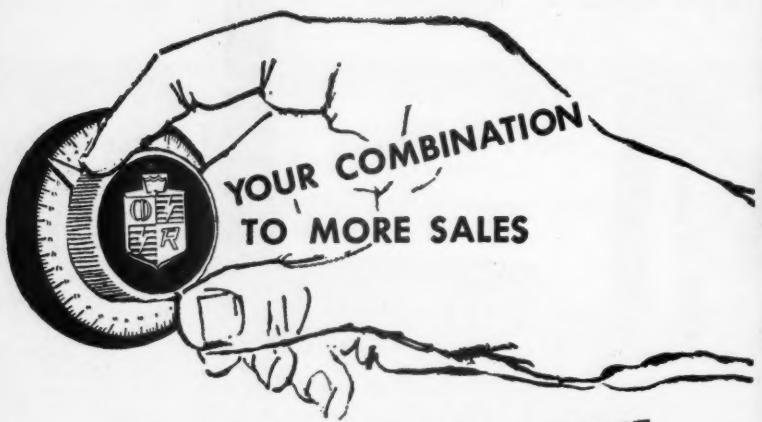
TR-4



TR 11 and 12

Everything You Need for Profitable Rotor Sales

CDR ROTORS have EVERYTHING



THE COMPLETE LINE

. . . a model for every need . . . whatever the application there is a CDR Rotor that meets the situation best!

PRE-SOLD FOR YOU!

The greatest coverage and concentration of full minute spot announcements on leading TV stations in every major rotor market is working for YOU...pre-selling your customers!

CORNELL-DUBILIER

THE RADIART CORP.

You Can Train at Home for Good Pay Jobs in

RADIO-TELEVISION

Fast Growing Industry Offers Good Pay, Security, Bright Future

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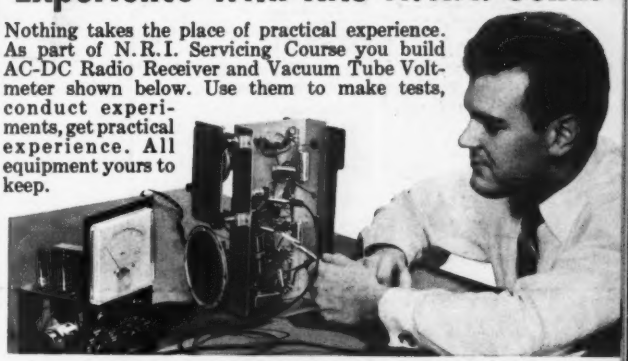

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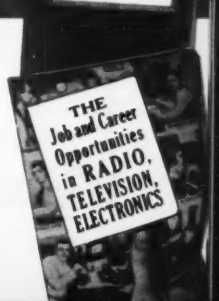

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Washington 9, D. C.

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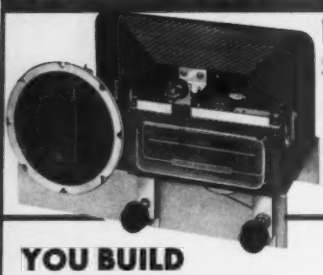
Practice Servicing-Communications with Kits of Parts N.R.I. Sends



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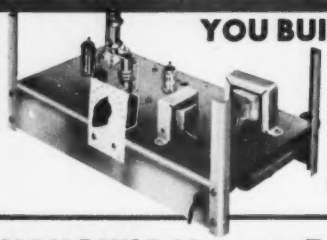

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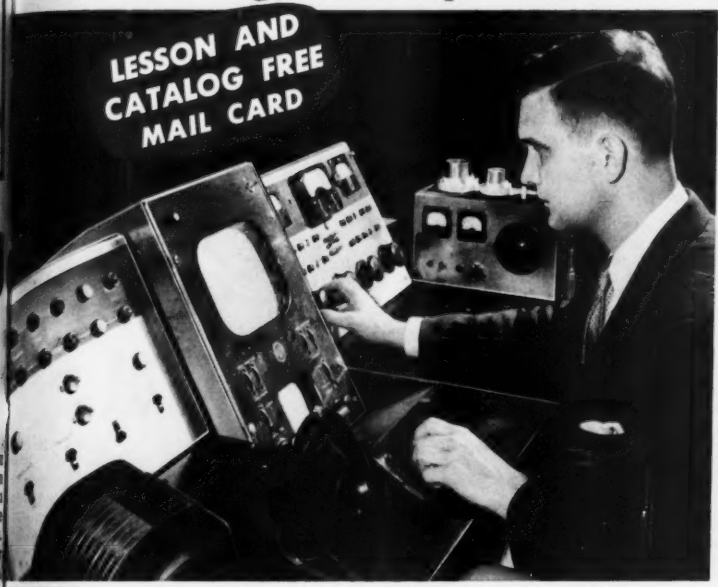

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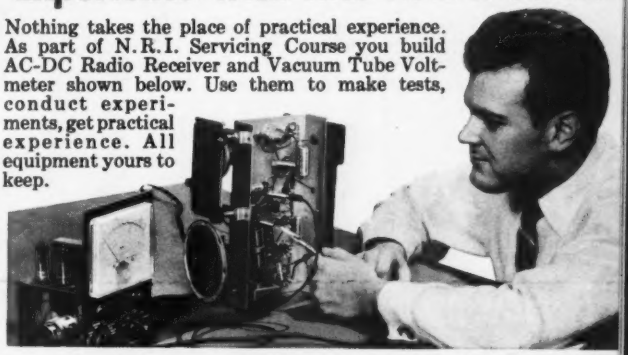

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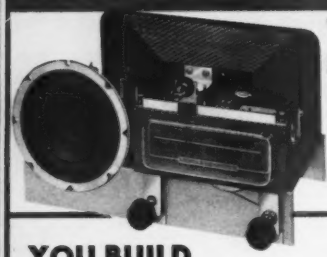

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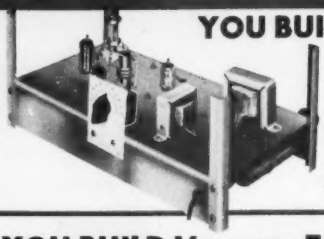

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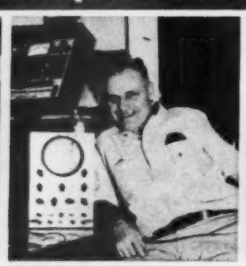

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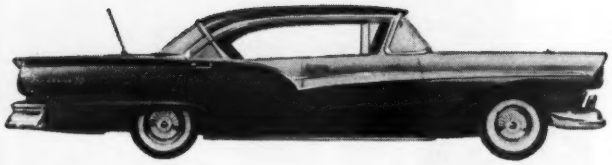


FORD

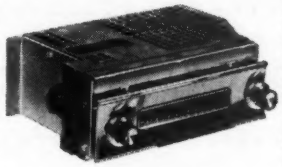
FOR '57...

CBS TUBES

FOR '57...

CBS TRANSISTORS

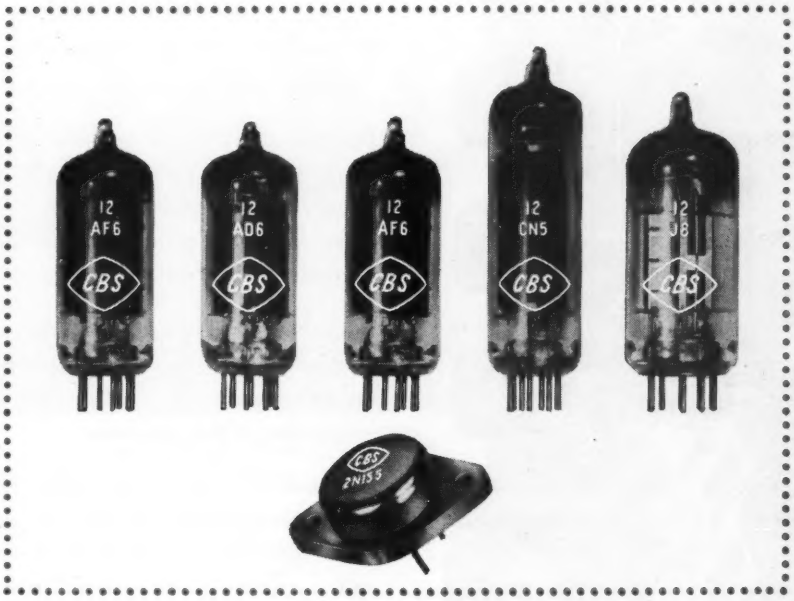
FOR '57



A new, sleek, long, low '57 Ford with the touch of tomorrow. Under the dash, a fine new Ford radio receiver, transistor-powered for the ultramodern touch. And in it, new low-voltage mobile radio tubes by CBS . . . new power output transistor by CBS.

That's only natural. CBS pioneered the first auto radio tube kit. CBS has been a major supplier of tubes to Ford and other leading auto radio set manufacturers for years. And now CBS offers tubes and transistors for the new "hybrid" auto radio receivers.

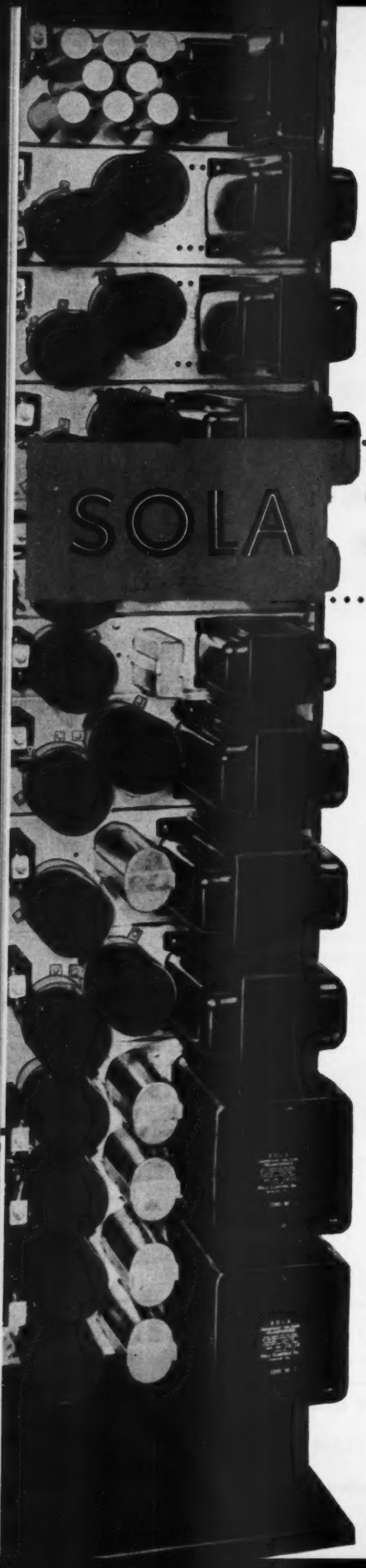
Whatever you need for auto radio replacements — tubes or transistors — old, modern, or ultramodern — follow the leading set manufacturers . . . replace with CBS.



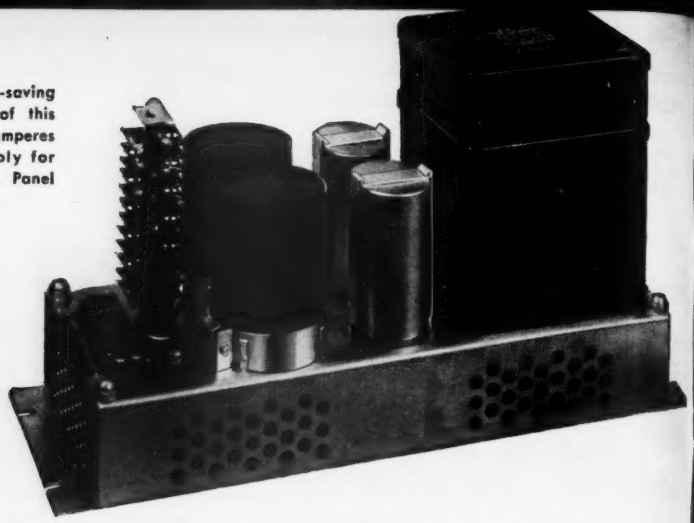
CBS tubes • semiconductors

Reliable products
through Advanced-Engineering

CBS-HYTRON
Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.



Note the space-saving compact design of this 150 volt DC 5 amperes Sola power supply for computer circuits. Panel height is only 7".



chooses Sangamo Capacitors for Germanium Power Supplies

Space-saving compactness and light weight . . . features assured by the exacting demands of Sola engineers . . . are among the many advantages of Sola Constant Voltage DC Power Supplies for intermittent, variable, pulse or high current loads. That's why they specify Sangamo Type DCM Electrolytic Capacitors for the high-capacitance filter section of these power supplies.

Besides contributing to the space-saving, weight-reducing design of the "Sola CV DC," Sangamo Capacitors minimize ripple voltage and insure steady, stable DC voltage. No further need for heavy, bulky choke components with their substantial and often-varying load voltage drops.

Just as Sangamo Capacitors meet the exacting specifications of Sola design engineers, they can meet yours . . . no matter how demanding —regardless of how specialized.

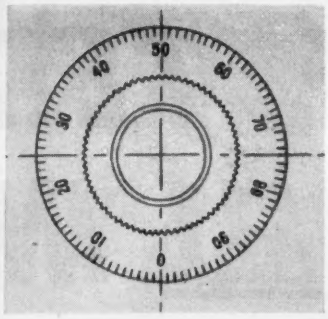
Sangamo DCM Electrolytic Capacitors provide excellent capacity stability with long life . . . exceptionally low equivalent series resistance . . . extremely high capacity for case size in low voltage ranges. Special design permits high ripple current without overheating. Can be supplied in maximum energy content rating of 80-watt seconds with maximum voltage rating of 450 VDC. Maximum capacity value of 33,000 mfds. can be supplied at 15 WVDC.

The Sangamo DCM Electrolytic Capacitor is housed in a seamless, drawn aluminum container with gasket-sealed molded alkyd resin base thermosetting plastic cover. Detail of cover construction insures minimum contact resistance in current carrying members and provides an adequate safety vent in case of heavy overload.

SANGAMO ELECTRIC COMPANY

CAPACITOR DIVISION • SPRINGFIELD, ILLINOIS

SC56-5



New heavyweight champion!

Hallicrafters new SX-101 receiver employs heaviest chassis in industry...incorporates V.F.O. feature*...has 2000° disc logging counter.

It's all amateur—and as rugged as they come! Hallicrafters presents the complete answer to ham reception, with every essential needed for today and for the future.

First—built like a battleship. Bigger. Heavier. Second—a marvel of stability—the result of 22 years of experience and development. Third—it brings you a long list of new features:

- **Complete coverage of 7 bands—160, 80, 40, 20, 15, 11-10 meters.**
- **Special 10 mc. pos. for WWV, plus coverage of major MARS frequencies.**
- **Exclusive Hallicrafters upper/lower side band selection.**
- **S-meter functions with A.V.C. off.**
- **Tee-notch filter.**
- ***Local oscillator output available for use in heterodyne V.F.O.**

PLUS: Band in use individually illuminated...built-in crystal calibrator...antenna trimmer...dual conversion...full gear drive from tuning knob to gang condensers...five steps of selectivity from 500-5000 cycles...sensitivity—less than 1 microvolt on all bands...direct coupled series noise limiter...50 to 1 tuning knob ratio...and many more.

For full specifications see it at your Radio Parts Supplier today!

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FROM
hallicrafters
CHICAGO 24, ILLINOIS

WHERE THE BEST IDEAS IN COMMUNICATIONS ARE BORN

EXPORT SALES: Philips Export Co.
100 East 42nd Street, New York 17, New York

CHANNEL MASTER PUTS NEW SELL IN T

DEALERS HAVE SOLD MORE *CHANNEL MASTER* T-W AND SHOWMAN ANTENNAS DURING THE PAST 60 DAYS THAN ANY OTHER ANTENNA DURING ANY 60 DAY PERIOD IN TV HISTORY

Isn't it time you called your Channel Master distributor?

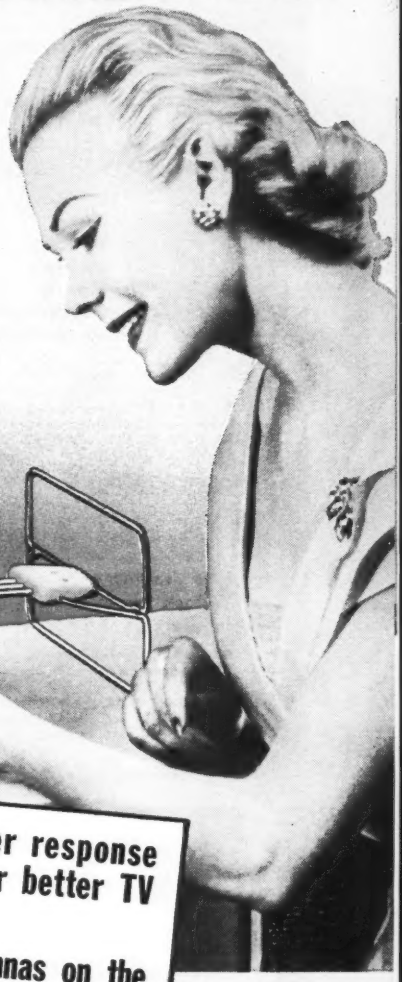
✶ 2-Page Spreads

✶ Full-Color Ads ✶ Full-page Ads

Month after month... all thru the prime TV buying months... this continuing series of sales-stimulating ads is creating loads of lively new prospects... right in your own selling area.

55,000,000
ads building new customers and sales for you!

NATIONAL ADVERTISING TV ANTENNAS!



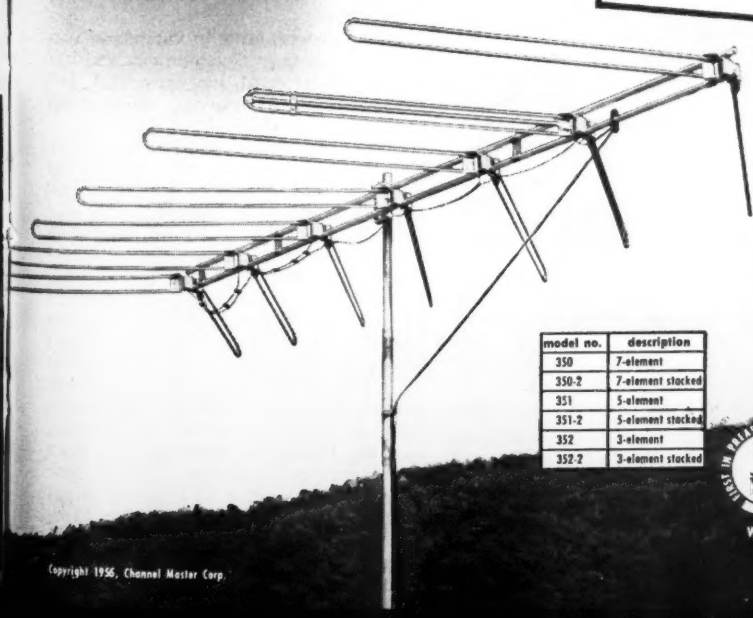
"Showman" INDOOR ANTENNA FOR VHF OR VHF-UHF

This smartly styled antenna overcomes consumer objection to ugly "rabbit-ear" antennas. Exclusive "Metro-Dyne" electronic tuning brings in pictures sharp and clear on *all* channels. Tuning knob with channel markings just like a TV set makes channel selection so easy. It's the most powerful indoor antenna ever developed . . . and it's backed with an **UNCONDITIONAL MONEY-BACK GUARANTEE.** Engineered for Black and White and COLOR.

model no.	description	type
3900	Mahogany & Gold	VHF
3901	Blond & Gold	VHF
3902	Ebony & Silver	VHF
3905	Mahogany & Gold	VHF-UHF

Tremendous consumer response emphasizes desire for better TV antennas . . .

and **there are no antennas on the market today that compare with these fabulous new Channel Master models.**



T-W OUTDOOR ANTENNA

The revolutionary new T-W is the very first TV antenna to use the "Traveling Wave" principle. This unique design electronically *reinforces* signals . . . *eliminates* "ghosts" and "snow" . . . *rejects* all unwanted signals and interference. In gain, front-to-back ratio, and mechanical strength, the T-W is unequalled by any other Broad Band antenna. Engineered for Black and White and **COLOR.**

model no.	description
350	7-element
350-2	7-element stacked
351	5-element
351-2	5-element stacked
352	3-element
352-2	3-element stacked

FIRST IN PREASSEMBLED ANTENNAS

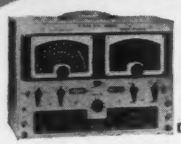
CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

Copyright 1956, Channel Master Corp.

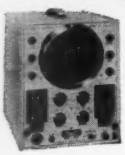
You're Ready for any Service Job with JACKSON "Service Engineered" Test Equipment



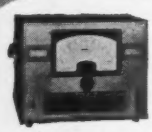
TVG-2 Sweep Marker Generator
Dealer Net **$259.95**

A complete TV generator plus crystal calibrator. Sweep 30KC through 216MC. Width adjustable from 0 through 18MC. Accurate Marker 4MC through 216MC. Crystal oscillator for frequencies to 20MC. Provision for Video Modulation.

CRO-2
Wide Band
High Sensitivity
5-inch Scope
Dealer Net **$225.00**

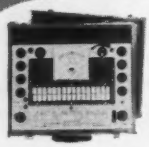


Flat within 1 db from 20 cycles through 4.5MC. Sensitivity from .018RMS volts per inch. Positive or Negative internal horizontal sync. Saw tooth sweep 20 cycles through 50KC. Many accessories including low capacity probes.



Model 655
Wide Range
Audio Oscillator
Dealer Net **$135.00**

Highly stable RC sine wave generator. Range 20 cycles to 200 kc in 4 steps. Up to 500 milliwatt output at impedances of 10, 250, 500, 5000 ohms or HiZ. Frequency characteristic 1db., 30 to 15k cycles. Accuracy 3% or 1 cycle.



Model 648A
Dynamic® Tube Tester
Dealer Net **$129.95**

Fastest tester on the market—and featuring famous Jackson Dynamic Circuit. Meter calibrated in Good-Bad, as well as percent Transconductance. Correct test voltage for all tubes including latest 600-mil types. Line Voltage Indicator.

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World's largest exclusive makers of factory-built service test equipment.
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Within the Industry

ROBERT L. SHAW has been named to the newly created post of national sales manager for the Radio and Television Division of *Sylvania Electric Products Inc.*

He formerly headed the company's wholly owned distributing firm, *Victor H. Meyer Distributing Corp.* Prior to that he was manager of branch operations, radio sales manager, and district sales manager in St. Louis, New Orleans, and Detroit. He joined *Sylvania* in 1952.

Mr. Shaw will have over-all responsibility for the division's field sales force and its distribution.

* * *

THE ASESA (Armed Services Electro-Standards Agency), Fort Monmouth, N. J., has announced that it is expanding its Qualification-Testing Program in view of a continuing and increasing need for qualified suppliers of electronic and electric parts.

To supplement Government testing laboratories, the ASESA recently inaugurated an extensive program providing for qualification testing of electronic and electric parts in commercial testing laboratories and in the plants of parts manufacturers. This program has proven so successful that it will be enlarged in scope to permit testing in the plants of electronic equipment manufacturers.

Equipment manufacturers who feel that their facilities are adequate for such testing should contact the Director, Armed Services Electro-Standards Agency, Fort Monmouth, N. J., for full details on this program.

* * *

MAXWELL RATNER has been named sales manager of *General Transistor Corp.* of Richmond Hill, N. Y. He was formerly sales manager and development engineer of *Germanium Products Corp.*

Prior to his most recent association, he was employed by the research division of New York University as a project engineer and project director on the secretariat of the panel on electron tubes of the Research and Development Board. There he supervised and maintained liaison on all semiconductor contracts with the government.

* * *

WALTER O. STANTON, president of *Pickering & Company,* Oceanside, N. Y., has been elected president of the Audio Engineering Society succeeding Col. Richard H. Ranger, president of *Rangertone,* Newark, N. J.

Mr. Stanton, who joined *Pickering* in 1948, is also secretary of the Institute of High Fidelity Manufacturers and the association's representative on the American Standards Association committee on sound recording and reproduction.

Sherman H. Fairchild, president of *Fairchild Recording Equipment Company,* was elected executive vice-president of the society. Henry J. Shroeder, president of *Shroeder Sales Company,* Cleveland, was named central vice-president, while Ross H. Snyder, manager of the custom products department of *Ampex Corp.,* was chosen western vice-president.

C. J. LeBel, chief engineer of *Audio Instrument Co., Inc.,* was re-elected secretary for his sixth consecutive term. Ralph A. Schlegel, technical facilities supervisor of *WOR,* was re-named treasurer.

* * *

DR. HARVARD L. HULL has resigned his post of president of *Farnsworth Electronics Company* to accept the position of vice-president of *Litton Industries,* Beverly Hills manufacturer of digital computers and controls, microwave power tubes, inertial guidance, radar, and other electronic components.

Dr. Hunt, who received his Ph.D. in physics from Columbia University, joined *Sperry Gyroscope Co.* following his graduation. He remained with the firm for ten years, leaving to join *Tennessee Eastman Corporation* at Oak Ridge.

He has been active in various phases of atomic energy development and has served on several governmental and industrial atomic energy committees.

* * *

HERBERT H. FROST, first president of the Radio Manufacturers Association —predecessor of today's RETMA, died recently after a five-month illness. He was 63 years old . . . **DR. BERNARD SALZBERG** has been named chief scientist of the Research and Engineering Division of *Airborne Instruments Laboratory,* Mineola, N. Y. He was formerly associated with the Naval Research Laboratory in Washington . . . *The M. J. Johnson Co. Inc.* has named **OTTO M. LERZ, JR.** vice-president of its new products department . . . **DR. HENRY G. GIULIANI** has been appointed to the newly created post of assistant to the director of engineering and sales for *Gabriel Elec-*

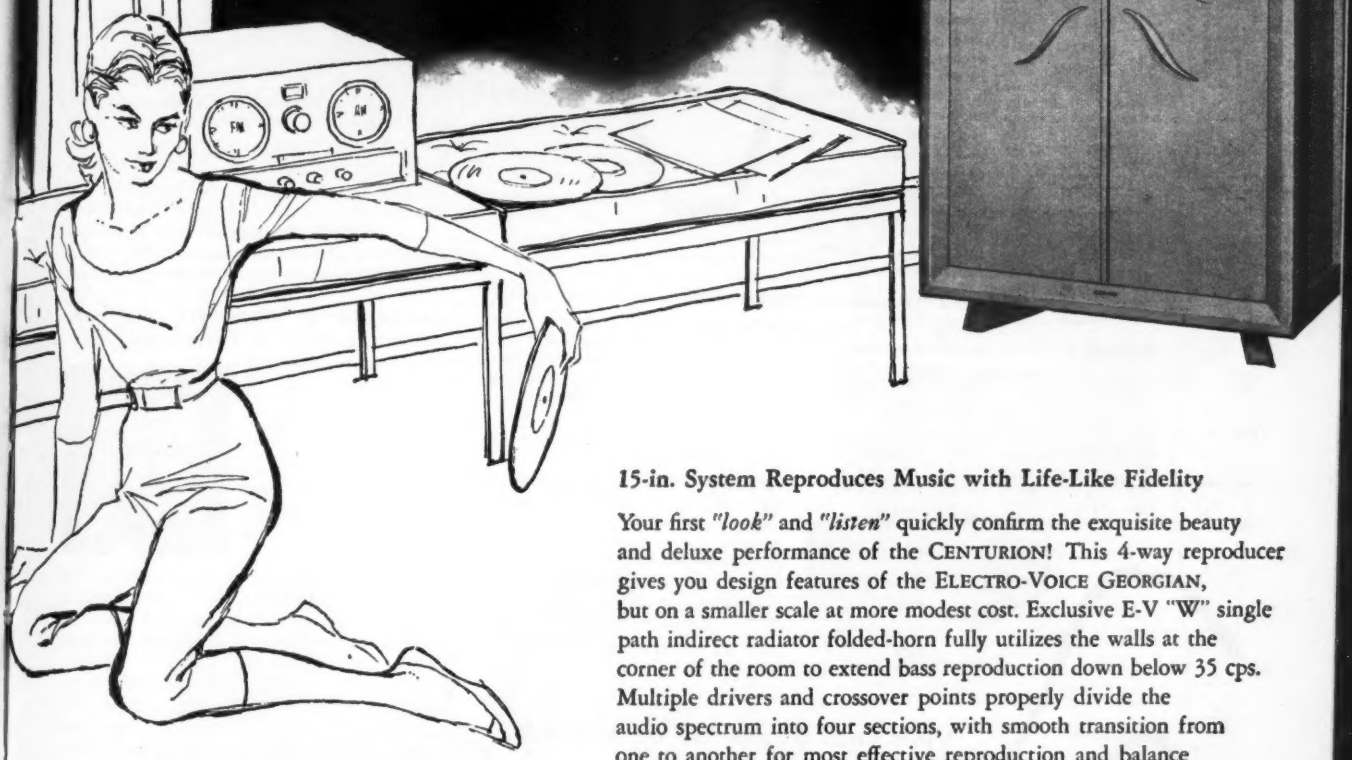
THE NEW

Electro-Voice®

Centurion IV

COMPLETE 4-WAY SPEAKER SYSTEM

for only $325.00



Selected hardwood veneers are hand-rubbed to lustrous finish on all exposed sides. Brushed-brass grille gives rich accent. Makes a striking appearance in any home. Size: 39 in. high, 29 in. wide, 21½ in. deep.

15-in. System Reproduces Music with Life-Like Fidelity

Your first *"look"* and *"listen"* quickly confirm the exquisite beauty and deluxe performance of the CENTURION! This 4-way reproducer gives you design features of the ELECTRO-VOICE GEORGIAN, but on a smaller scale at more modest cost. Exclusive E-V "W" single path indirect radiator folded-horn fully utilizes the walls at the corner of the room to extend bass reproduction down below 35 cps. Multiple drivers and crossover points properly divide the audio spectrum into four sections, with smooth transition from one to another for most effective reproduction and balance of bass, mid-range, treble and very highs. Level controls permit easy adjustment of "presence" and "brilliance" to room acoustics.

Look and Listen...at your E-V High-Fidelity Distributor.

CENTURION IV. Complete 4-way 15-in. speaker system with E-V Model 117 Package of driver components installed in corner enclosure.
Mahogany. Net, $325.00 Blonde. Net, $335.00
Walnut. Net, ... $343.80

SENIOR CENTURION IV. Complete 4-way 15-in. speaker system with E-V Model 105 Package of driver components installed in corner enclosure.
Mahogany. Net, $395.00 Blonde. Net, $405.00
Walnut. Net, ... $413.80

CENTURION MODEL KD3 KIT. Do-it-Yourself Folded Horn Enclosure Kit. Every piece precut. Hardwood exterior surfaces. Glue, screws and nails. Detailed instructions. Net, ... $87.00

E-V MODEL 105 High Efficiency System only, without enclosure. Has 15WK, 848HF, T35, X336 and two AT37. Net, ... $217.00

E-V MODEL 117 Medium Efficiency System only, without enclosure. Has 15BWK, 847HF, T35B, X336 and two AT37. Net $145.00

New Catalog-Guide gives quick facts on Speaker Systems for true high-fidelity music reproduction. Send 25¢ to cover postage and handling. Specify Catalog No. 117-N612

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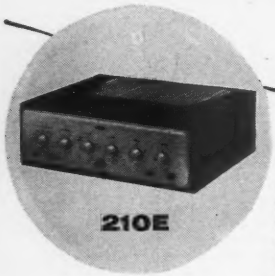
EXPORT: 13 East 40th Street, New York 16, U. S. A.
Cables: ARLAB

New Styling...
New Features...
A Completely **New** Line
from **H. H. Scott**



210E

3 NEW FEATURE-PACKED AMPLIFIERS!

(Models 99C, 210E complete amplifiers, 121C preamplifier) Color-marked Green Dot controls that make it easy for your family to operate your hi fi system . . . smartly designed mahogany cabinets . . . years ahead features that defy obsolescence . . . that's H. H. Scott for '57, your best dollar investment. See for yourself!

330B

4 NEW SUPER-SENSITIVE TUNERS!

(Models 330B, 331B AM-FM tuners; 311B, 310B FM tuners) For the first time AM that gives you audio response beyond 10 kc . . . FM with new wide-band circuitry that makes drift a thing of the past . . . AM-FM tuners equipped for Stereophonic (binaural) operation. That's H. H. Scott for '57. Hear for yourself!

280

2 COMPLETELY REDESIGNED POWER AMPLIFIERS!

(Models 240, 280) Exclusive Dynamic Power Monitor on Model 280 affords full output on music, yet protects expensive speakers against burnout . . . variable damping controls for perfect speaker matching . . . new exterior styling . . . clean distortion-free performance typical of all H. H. Scott components. Judge for yourself!

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tronics Division . . . **HORACE B. McCOY,** veteran career service official, has been elevated to the post of Administrator of the U. S. Commerce Department's Business and Defense Services Administration. He was formerly Deputy Administrator . . . **BILL ASHBY** has been named director of service engineering for *Cornell-Dubilier Electric Corporation* . . . *Aerovox Corporation* has named **G. EMERSON PRAY** to the post of general manager of its special products division. He will be in charge of all activities connected with printed wiring, etched circuitry, pressed silver products, electronics subassemblies, and electronics equipment . . . **JOSEPH P. RICE** is the new chief engineer of *Fanon Electric Company,* Brooklyn manufacturer of intercoms and phonographs . . . The appointment of **DR. EARL L. STEELE** as chief development engineer of the Device Development Department in the Semiconductor Products Division has been announced by *Motorola Inc.* . . . **NILS HILLSTROM** has been named national sales manager of *Newcomb Audio Products* . . . *Amphenol Electronics Corporation* has appointed **RICHARD P. THORNTON** to the post of marketing manager for the aircraft and guided missile industries . . . **ROBERT G. BACH** has rejoined *Fairchild Recording Equipment Company* in the capacity of sales manager.

* * *

LAWRENCE G. HAGGERTY has been named president of *Farnsworth Electronics Company* of Fort Wayne, Ind., a division of *International Telephone and Telegraph Corporation.*

He joined the system in 1950 as director of operations in the *Capehart-Farnsworth Company* division. In 1952 he was elected vice-president and in 1954 named president of that division and a member of its management advisory board.

Prior to joining *IT&T,* he was associated with *RCA Victor* and *F. L. Jacobs Company.* He holds a mechanical engineering degree from Marquette University, Milwaukee. He succeeds Dr. Harvard L. Hull in his new position.

* * *

COL. WILLET J. BAIRD, USA (ret.) has been named editor of "Signal," official publication of the Armed Forces Communications & Electronics Association. He succeeds the late Col. George P. Dixon.

Col. Baird was born at West Point in 1902 and graduated from West Point with the class of 1926. He served with various units and on staff assignments in the U. S. and Hawaii. He was assigned as Professor of Military Science and Tactics at Valley Forge Military Academy and as Aide to the governor of Pennsylvania. His most recent appointment prior to his retirement in July of this year was as Assistant Commandant (Administration)

(*Continued on page* 144)

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- Parts to conduct many experiments and build Continuity Checker, RF Oscillator, TV Circuits, Audio Oscillator, TRF Receiver, Signal Generator.
- Professional Multitester
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Norelco ***F.R.S.***

speakers are available 5", 8" or 12" sizes in standard impedances. Priced from $6.75 to $59.98

Blue prints are available for the do-it-yourself enclosure builder.

You will hear a remarkable difference in the clarity of Norelco *Full Resonance Speakers. In a single speaker, twin-cones reproduce low frequencies, middle range, as well as the higher frequencies extending beyond the audible range—without distortion.

WHY ARE NORELCO FRS SPEAKERS SO EXCEPTIONAL?

They have incorporated a number of technical refinements which are evident the moment you listen. The air gap has been made long so that the coil is completely enclosed in an even magnetic field at all times. A copper ring has been fitted into the deep air gap to keep the voice coil impedance constant over the whole frequency range: this avoids incorrect matching. High flux densities are obtained through the use of "Ticonal" magnet steel.

Norelco speaker-matched enclosures are scientifically designed acoustical boxes which enhance the exceptional tone qualities of FRS speakers; bringing out their true performance values.

Norelco FRS Speaker Enclosures are available in three sizes to match the characteristics of the speaker in use. Supplied in either mahogany or blond, these enclosures incorporate a removable base permitting the enclosures to be placed horizontally or vertically to suit any room arrangement or decor.

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Giant opportunity field! Join the thousands Coyne Home Training is preparing for a successful future in TV—open the door to better pay jobs, *or* your own business! COYNE—a leading residential, practical school—oldest of its kind—established 1899—*is the institution behind this training.*

Here is **MODERN—QUALITY TELEVISION** Home Training designed to meet the rigid standards that have made Coyne famous. You get personal supervision of Coyne Staff who know TV and know how to teach. **Learn quickly and easily in spare time.** No previous experience or advanced education necessary.

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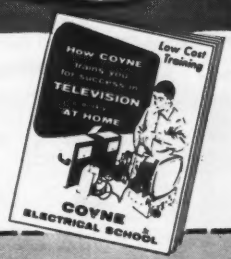

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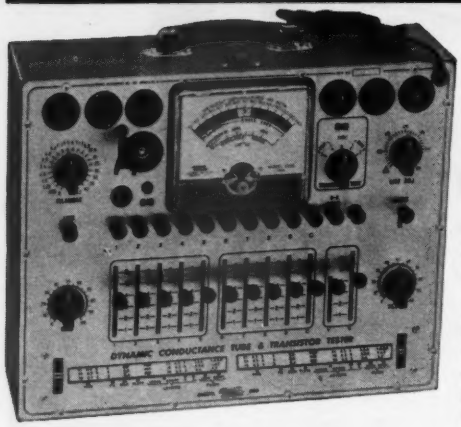

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KIT . . . ONLY $69.95 WIRED $109.95

Speedy, simple operation, close simulation of actual tube operating conditions, unexcelled thoroughness, sensitivity and accuracy of test, excellent electrical and mechanical design—these are the superb advantages of the #666.

APPLICATIONS: Ideal for COLOR AND MONOCHROME TV servicing: Tests all receiving tubes including 4, 5, 6 and 7-pin, octal, loctal, miniature 7 and 9-pin, subminiature 5, 6, 7-pin (in-line base) and 8-pin (circular base) receiving tubes, many small transmitting and special-purpose tubes, voltage regulators, cold-cathode rectifiers, electron-ray indicators, and ballast tubes. Tests TV picture tubes with accessory adaptor. Tests n-p-n and p-n-p transistors.

ELECTRICAL CHARACTERISTICS

TRANSISTOR TEST: Dependable industry-approved two-step test on both n-p-n and p-n-p transistors, using internal dc power supply: (1) leakage measurement of collector current and (2) direct reading of current amplification factor or Beta. Saves you the cost of a separate transistor tester.

DYNAMIC CONDUCTANCE TUBE TEST: Composite indication of mutual conductance (Gm), plate conductance (Gp) and peak emission capability. Test accuracy is assured by the following:

- Multi-circuit lever switch for speedy simultaneous selection of any one of 4 combinations of 3 plate, 3 screen and 3 ranges of control grid voltages.
- Grid voltage variable over each range with a 5% accurate wire-wound potentiometer.
- 5 ranges of meter sensitivity using 1% carbon-deposited shunts and 5% accurate wire-wound meter range potentiometer.
- 200 ua meter provides unusual sensitivity for checking tubes with low cathode current.
- Rectifiers tested near maximum rated current for extra accuracy.

Leakage Test: Direct-reading of inter-element leakage in ohms, with these features:

- Sensitive 200 ua meter permits accurate readings up to 20 megohms.
- DC leakage test voltage always applied in correct polarity to eliminate emission effects from readings.
- Accurate heater-Cathode leakage readings achieved by isolation of heater and cathode from remaining tube elements during test.
- 10 push-button switches permit rapid insertion of alternate tube elements in leakage test circuit.

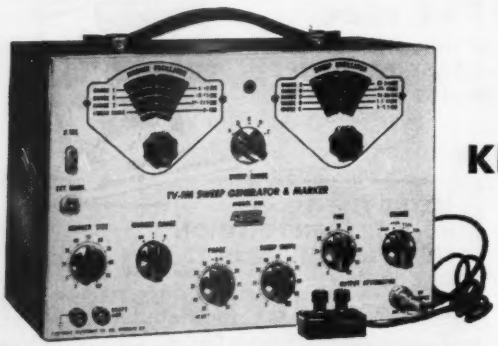
Each active tube element can be **individually** connected to any of the following busses: plate voltage, screen voltage, grid voltage, filament voltage, ground (cathode and filament return), no connection.

Multi-section tubes have each section **individually** tested by rapid push-button selection—while all sections are simultaneously drawing full-rated current . . . Pentodes are tested **as pentodes,** with no "lumping together" of tube elements.

Filament switch provides selection from 20 filament voltages: adequate for all older tube types in use as well as for the new 600, 450 and 300 ma series string tubes.
Line voltage may be read directly off the dial of the line-adjust rheostat on the panel with good accuracy.
Rollchart is extensive, up-to-date, and includes settings for all new series string type tubes.
Exceptional control accuracy makes possible a very easy method for developing accurate test settings for new tube types before such data is published on a new rollchart. Snap-in rollchart windows for easy entry of new test data.
Power: operates from 105-130 volts AC line, 50/60 cps. Provided with pilot lamp and fused for safety.

PHYSICAL SPECIFICATIONS

Components specifically selected for ruggedness in day-after-day servicing.
New gear-driven rollchart mechanism is easily assembled, provides smooth trouble-free operation. Snap-in windows permit settings for new tubes to be entered on rollchart without disassembly.
The 10 individual element push-buttons are ganged on one easily-mounted assembly through which they are interlocked mechanically and interconnected electrically to simplify mounting and wiring and assure safer operation.
The 10 SIX-position lever switches plus the two lever switches for meter shunt, and plate, screen, and range of grid voltage selection, are all ganged together to form one quick mounting assembly for not only very rapid settings but easier wiring for the kit constructor.
The only internal adjustments in this tester are two calibrating rheostats for the line adjust and leakage measurement circuits. All the equipment required to calibrate the tester is one voltmeter of any type.
The "Tube Merit" Switch, through which plate, screen, and grid voltages are applied to the tube under test, is of the spring-return type to eliminate the possibility of damage to the tube tester by continuous operation of a defective tube.
Deep-etched, heavy gauge, brushed satin aluminum panel; 4½", 200 ua D-Arsonval meter movement, in clear lucite case; rugged grey wrinkle steel carrying case with matching steel cover and carrying handle for easy portability. **Dimensions:** 12" x 15" x 6". **Weight:** 20 lbs.



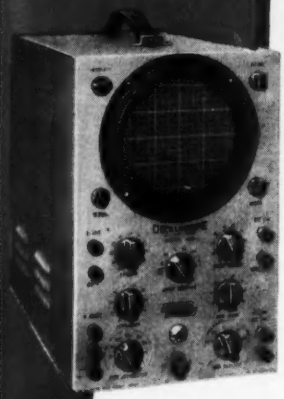
NEW! TV-FM SWEEP GENERATOR AND MARKER #368

KIT . . . ONLY $69.95 WIRED . . $119.95

The most highly perfected service instrument of this type presently being offered in either kit or wired form at ANY price!
For accurate alignment of FM, TV Monochrome and Color sets; all RF, IF and oscillator stages, including intercarrier; all sound and video traps. High RF output for alignment of boosters, tuners, and other RF circuits without need for additional amplification.

Outstanding ease and accuracy in alignment. **Entirely electronic sweep circuit** with accurately biased increductor provides **superb linearity** on both sides of center frequency. **Newly-designed AGC circuit** automatically adjusts oscillator for maximum output on each band with minimum amplitude variations. Resonance-free RF choke eliminates "suck-out" points anywhere in the RF spectrum. Sweep generator range 3-216 mc in **5 OVERLAPPING FUNDAMENTAL BANDS.** Sweep width continuously variable from 0-3 mc lowest maximum deviation to 0-30 mc highest maximum deviation. **Variable marker generator range** from 2-75 mc in **3 FUNDAMENTAL BANDS** plus a calibrated harmonic band (60-225 mc). Variable marker calibrated with **internal crystal marker generator. 4.5 mc crystal included.** External marker provision. **Edge-lit hairlines** eliminate parallax. Double pi line filter. Output impedance 50 ohms. Continuously variable separate marker size control. 4-step decade "course" and continuously variable "fine" attenuators for both sweep and marker output together. Complete **2-way blanking** eliminates return trace. Narrow range **phasing control** for accurate alignment. Cables included: output, scope horizontal and compensated scope vertical cables.

NEW! COLOR and Black-&-White LAB & TV 5" OSCILLOSCOPE #460
KIT $79.95. Wired $129.50



The FINEST professional 5 mc wide-band scope value. Ideal for research, h-f & complex waves, plus Color & Monochrome TV servicing. Flat from DC to 3.58 mc ±1 db (color burst freq.), flat DC to 4.5 mc +1, −3 db. Vert. sens. 25 rms mv/in. Vert. Z 3 megs. Has the following outstanding features not found in scopes up to several times its price, kit or wired:

VERTICAL AMPLIFIER: direct-coupled (DC) thruout to eliminate l-f phase shift; **push-pull thruout** for negligible distortion; **K-follower coupling** between push-pull pentode stages for extended h-f resp. (minimizes h-f phase shift, extends useful resp. to 10 mc); full-screen undistorted vert. defl; 4-step freq-compensated decade step attenuator up to 1000:1. **SWEEP CIRCUIT:** perfectly linear sweeps, 10 cps – 100 kc (ext. cap. for down to 1 cps); **pre-set TV vert. & hor. positions** (30 & 7875 cps); automatic sync. ampl. & limiter eliminates sync amplitude adj. **PLUS:** direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; anti-glare filter; bezel fits std photo equipt. **OTHER IMPORTANT FEATURES:** High intensity trace CRT. Finest sq. wave resp. (.06 usec rise time). Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in voltage calibration. Intensity mod. Sawtooth & 60 cps outputs. Astigmatism control. Retrace blanking. Instant, drift-free full-screen vert. positioning & 2X full-screen hor. positioning. **Bal., cal., astig. adj. externally accessible.** 5UP1 CRT, 2–6AU8, 2-6CB6, 1-12AU7A, 2-6J6, 1-6AX5, 1-1V2. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. Designed for easy building at home with no special equipment. 13" x 8½" x 16". 30 lbs.

SCOPE DIRECT PROBE* #PD: KIT $2.75. Wired $3.95. Eliminates stray-pick-up & signal re-radiation.

SCOPE DEMODULATOR PROBE* #PSD: KIT $3.75. Wired $5.75. Demodulates AM carriers between 150 kc and 250 mc.

SCOPE LOW CAPACITY PROBE* #PLC: KIT $3.75. Wired $5.75. For signal tracing in high frequency, high impedance & wide-band circuits (as in TV) without distortion from overloading or frequency discrimination.

150 kc to 435 mc with ONE generator!

New! RF SIGNAL GENERATOR #324
KIT $26.95. Wired $39.95
for COLOR and Monochrome TV servicing

New wide-range, stable generator – better value then generators selling at 2 or 3 times its cost! Ideal for: IF-RF alignment, signal tracing & trouble-shooting of TV, FM & AM sets; marker gen.; 400 cps audio testing; lab. work. 6 fund. ranges: **150-400 kc, 400-1200 kc, 1.2-3.5 mc, 3.5-11 mc, 11-37 mc, 37-145 mc; 1 harmonic band 111-435 mc. Freq. accurate to ±1.5%;** 6:1 vernier tuning & excellent spread at most important alignment freqs. Etched tuning dial, plexiglass windows, edge-lit hairlines. Colpitts RF osc., directly plate-modulated by K-follower for improved mod. Variable depth of int. mod. 0-50% by 400 cps Colpitts osc. Variable gain ext. mod. amplifier: only 3.0 volts needed for 30% mod. Turret-mounted coils slug-tuned for max. accuracy. Fine & Coarse (3-step) RF attenuators. RF output 100,000 uv; AF sine wave output to 10 volts. 50-ohm output Z. 5-way jack-top binding posts for AF in/out; coaxial connector & shielded cable for RF out. Tubes: 12AU7, 12AV7, selenium rectifier; xfmr-operated. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. 8" x 10" x 4¾". 10 lbs.

The specs are the proof...

4 NEW BEST BUYS by EICO

for COLOR and Monochrome TV servicing

New! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)
KIT $29.95. Wired $49.95

UNI-PROBE: exclusive with EICO! Terrific time-saver! Only 1 probe performs all functions–a half-turn of probe-tip selects DC or AC-Ohms.

The new leader in professional peak-to-peak VTVMs. Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't-burn-out circuit. **7 non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC Volts, Ohms. Uniform 3 to 1 scale ratio for extreme wide-range accuracy. **Zero center.** One zero-adj. for all functions & ranges. **1% precision** ceramic multiplier resistors. Measure **directly** peak-to-peak voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200. DC/RMS sine volts: 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 v. with HVP probe, & 250 mc with PRF probe). Ohms: 0.2 ohms to 1000 megs. 12AU7, 6AL5, selenium rectifier; xfmr-operated. 8½" x 5" x 5". Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. 7 lbs.

New! DELUXE PEAK-to-PEAK VTVM #249 with 7½" METER & UNI-PROBE (pat. pend.)
KIT $39.95. Wired $59.95

All the advanced & exclusive features of #232–PLUS the extra convenience and readability of its big 7½" meter. Your ideal bench instrument.

VTVM RF PROBES* #PRF-11 or PRF-25: KIT $3.75. Wired $4.95. Accuracy ±10%. Use with any 11 or 25 megohm VTVM.

VTVM HV PROBE #HVP-2: Wired $4.95. Complete with multiplier resistor. Measures up to 30 kv with any VTVM or 20,000 ohms/volt VOM.

*Only EICO Probes have all these features: fully shielded; rugged screwdriver-board ports mountings; shock-mounted floating construction; swivel-action; color-coding; easy parts accessibility.

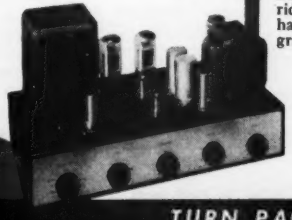
COMPLETE with Preamplifier, Equalizer and Control Section

New! 20-WATT Ultra-Linear Williamson-type HIGH FIDELITY AMPLIFIER #HF20
KIT $49.95. Wired $79.95

A low-cost, complete-facility amplifier of the highest quality that sets a new standard of performance at the price, kit or wired. Every detail, down to the etched, brushed solid brass control plate, is of the fine quality EICO is famous for.

Rated power output: 20 watts (34 w peak). **IM distortion (60 cps: 6 kc/4:1) at rated power:** 1.3%. **Mid-band harmonic distortion at rated power:** 0.3%. **Maximum harmonic distortion between 20 and 20,000 cps at 1 db under rated power:** approx. 1%. **Power response (20w):** ±0.5 db 20-20,000 cps; ±1.5 db 10-40,000 cps. **Frequency response (¼w):** ±0.5 db 13-35,000 cps; ±1.5 db 7-50,000 cps.

5 feedback equalizations for LP's & 78's including RIAA. Variable turnover feedback tone controls do not affect volume & permit large boosts or cuts at either end of audio spectrum with mid-freqs. unaffected. Loudness control & separate level set control on front panel. Low Z output to tape recorder. 4 hi-level switched inputs: tuner, tv, tape, auxiliary (xtal/ceramic phono or 2nd tuner); 2 low-level inputs for proper loading with all leading magnetic, FM & quality xtal cartridges. Hum bal. control. Extremely fine output transformer has interleaved windings, tight coupling, careful balancing & grain-oriented steel. 8½" x 15" x 10". 24 lbs.



These amazing EICO values are **NOW IN STOCK** at your nearest distributor. Examine them side-by-side with **ANY** competitor. You'll see for yourself why indeed EICO is your **BEST BUY.** Fill out coupon on reverse page.

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EICO's mass purchasing and world-wide distribution, together with advanced electronic design, produce values never before possible . . . to give you **Laboratory Precision at Lowest Cost!**

GET the MOST for YOUR MONEY! Don't buy ANY test instrument till you put the EICO INSTRUMENT (kit or wired) equivalent before you—and . . .

Compare **advanced electronic design:** see the latest in circuitry and features.

Compare **finest components:** see the famous brands you know and trust, such as GE, Centralab, Mallory, etc.

Notice **ease of construction and operation:** Exclusive "Beginner-Tested" Manuals make assembly and operation step-by-step, quick, crystal-clear. "You build them in one evening—they last a lifetime!"

Check **5-Way Guarantee:** Only EICO gives you this exclusive **complete** protection! EICO guarantees components, instructions and satisfactory operation – **AND** guarantees **service and calibration** for the **LIFETIME** of the instrument, at less than cost of handling.

Compare **feature for feature, dollar for dollar.**

There's an EICO distributor right nearby in your own neighborhood — over 1200 coast-to-coast. EICO planned it that way so that you can easily examine EICO **BEFORE YOU PUT DOWN ONE CENT OF YOUR MONEY!**

COMPARE any of EICO's 50 models **SIDE BY SIDE** with **ANY** competitor. Then **YOU** judge who's giving you the **MOST** for your money.

Over 1,000,000 EICO instruments in use . . . You'll agree EICO gives you **LABORATORY PRECISION AT LOWEST COST.**

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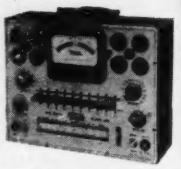
FREE 1957 EICO CATALOG!

Tells you how to SAVE 50% on your test equipment costs!

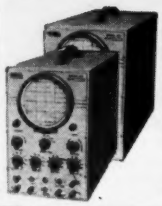


TUBE TESTER #625
KIT $34.95
Wired $49.95
• tests 600 mil series string type tubes
• illuminated roll-chart

Pix Tube Test Adapter $4.50

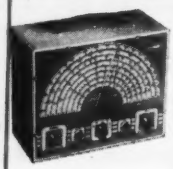
***New!* GEIGER COUNTER #803**
KIT $19.95 Wired $29.95

(less batteries)
Professional, all-electronic, sensitive, rugged—at lowest cost! Indicates by neon lamp & headphone clicks.



5" PUSH-PULL OSCILLOSCOPE #425
KIT $44.95
Wired $79.95
•
7" PUSH-PULL OSCILLOSCOPE #470
KIT $79.95
Wired $129.50

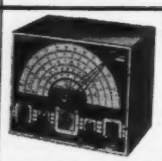
VACUUM TUBE VOLTMETER #221
KIT $25.95
Wired $39.95
•
DELUXE VTVM : 214 (7½" METER)
KIT $34.95
Wired $54.95



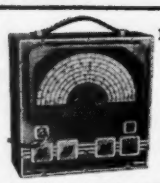
RF SIGNAL GENERATOR #320
KIT $19.95
Wired $29.95
150 kc-34 mc, calibrated harmonics to 102 mc. Pure or mod. RF, & Colpitts osc. 400 cps sine outputs.

NEW!
REDI-TESTER #540
KIT $12.95
Wired $15.95
Multi-range ac/dc voltmeter, ammeter, ohmmeter, wattmeter, leakage checker for home & auto repairs.

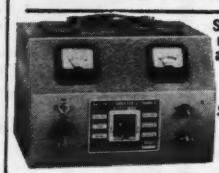
#944 FLYBACK TRANSFORMER & YOKE TESTER
KIT $23.95
Wired $34.95
• fast check all flybacks & yokes in or out of set.
• spots even 1 shorted turn!



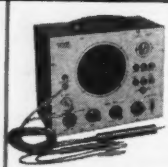
Range 500 kc—228 mc on fund. Cont. sweep width control, 0—30 mc.
KIT $34.95
Wired $49.95
TV/FM SWEEP GENERATOR #360
5MC-4.5MC CRYSTAL ..... $3.95 ea.



1% accuracy on all 7 ranges. Range 75 kc—150 mc. Volt reg.
KIT $39.95
Wired $59.95
DELUXE RF SIGNAL GENERATOR #315

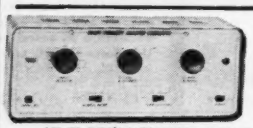


Sep. voltmeter & ammeter
KIT $29.95
Wired $38.95
6V & 12V BATTERY ELIMINATOR & CHARGER #1050



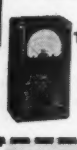
Sep. hi-gain RF & lo-gain audio inputs. Special noise locator. Calibrated wattmeter.
KIT $24.95
Wired $39.95
DELUXE MULTI-SIGNAL TRACER #147

Reads 0.5 ohms —500 megs, 10 mmfd—5000 mfd, power factor.
KIT $19.95
Wired $29.95
R-C BRIDGE & R-C-L COMPARATOR #950B

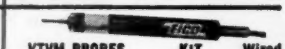


NEW!
HI-FI PREAMPLIFIER #HF-61
KIT $24.95 Wired $37.95. With Power Supply: KIT $29.95. Wired $44.95
Feedback circuitry thruout! Preamp-equalizer, tone controls, scratch & rumble filters, K-follower output.

20,000 Ohms/Volt MULTIMETER #565
KIT $24.95
Wired $29.95



1000 Ohms/Volt MULTIMETER # 536
KIT $12.90
Wired $14.90



VTVM PROBES	KIT	Wired
Peak-to-Peak	$4.95	$6.95
RF	$3.75	$4.95
High Voltage Probe-1		$6.95
High Voltage Probe-2		$4.95
SCOPE PROBES		
Demodulator	$3.75	$5.75
Direct	$2.75	$3.95
Low Capacity	$3.75	$5.75

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Electronic Aids for Small Aircraft

Lower left corner of the Cessna instrument panel shows "package" unit with tunable v.h.f. receiver, six-channel transmitter, and low-frequency receiver. At top left is the scope indicator for presentation of omnirange signals. Refer to article.

By
DAVID BROWN
Electronic Services Co.

A review of some of the electronic gear that the airport technician will encounter and be called upon to service.

THE great increase in private flying among businessmen, farmers, and others within the last few years has brought aviation electronics into a new importance. As the sales of small aircraft have skyrocketed it has had a very stimulating effect on the production of radio and navigation gear designed for these private and business type aircraft. Because of this surge of aircraft business a host of small, related industries have become great producers complete with research facilities and field engineers. Not the least of these are the producers of aviation electronic equipment which have grown from a small handful of little companies and little departments of big companies into "junior-grade titans" of industry. They are producing intricate radio, navigation, and control gear that formerly was available only to the large airlines and military aircraft. They have accomplished this by eliminating elaborate circuitry and utilizing better design features. The net result has been a wider selection of equipment for the private pilot and new fields of endeavor for the electronics technician.

In this article we shall discuss some of the many electronic aids that are in current use in small aircraft. Important stress is put upon characteristics that affect aircraft performance such as weight, size, power drain, and any design features that may be detrimental to flight safety. For this reason aircraft installations use integrated units and combinations to prevent duplication of function wherever possible. Power supplies are highly versatile and designed so several units may obtain plate voltage from a single source.

Another important factor in the design of aircraft radio systems is the cost. Many of these planes are owned and operated by small concerns and individuals who are subject to a strict budget and cannot afford a large cash outlay for a complete communications system. Therefore, designers have devised "building block" methods whereby a complete system can be obtained in easy stages starting with a few basic units. One company advertises eighteen different combinations from primary to complete systems.

Of first importance to a pilot is some means of two-way communications so he can obtain weather information and flight instructions. An early answer to this problem came in the form of a single-channel transmitter and two-band receiver. The transmitter was a crystal-controlled oscillator feeding a single-ended power amplifier. The crystal was cut for the low operating frequency of 3105 kc. This frequency, however, has been changed by the FCC to 3023.5 kc., which is now the calling and working frequency for private aircraft in the low-frequency band. The receiver was a two-band affair tunable from 200 kc. to 400 kc. and across the standard broadcast band. Plate voltage was supplied by a vibrator power supply similar to the type used in many auto radios. Although many of these low-frequency systems are still in use in early model aircraft, they have a great many drawbacks. At the low transmitting frequency used by these sets a considerable length of wire must be strung about the aircraft to obtain good transmission characteristics. These antennas may be either fixed or trailing wire types. However, the added drag caused by these antenna systems and the possibility of a broken wire becoming tangled in control surfaces was a strong argument in favor of higher frequencies.

Lighter component parts, streamlined antenna systems, and better signal-to-noise ratio evolved the v.h.f. command systems of today. A typical v.h.f. system may have from four to twenty-seven crystal-controlled transmitter channels and a tunable v.h.f. receiver from 108 to 126 mc. A quarter-wave whip antenna gives very satisfactory communications for line-of-sight transmissions up to 75 miles or more, depending on altitude and atmospheric conditions. Most of these v.h.f. transmitters employ a twin triode, such as the 6J6, as an oscillator-tripler, another as tripler-doubler and a 6AK5 or 6AN5 for power output. Overtone crystals are used to generate fundamentals. The eighteenth harmonic is then taken as the operating frequency. A small, slug-tuned transformer with a loop for an indicator bulb and an antenna completes the two-watt v.h.f. transmitter. The audio output stage of the receiver usually doubles as the modulation circuit for the transmitter and plate voltage is derived from a common source with the receiver and other equipment.

A few dynamotor supply systems are

in use although vibrator systems are more popular because of lower cost. The "black box" for the power supply is usually an integrated piece of equipment which may house the audio output-modulator system or more complicated circuitry for an automatic direction finder or omnirange system.

The v.h.f. receivers feature slug tuning and dual impedance output so either headsets or speakers may be used. Receivers are usually part of a package that contains transmitter, v.h.f. receiver, and low-frequency receivers. These low-frequency receivers also have some means of receiving the 75-megacycle marker beacon that indicates airways and runway approaches. This whole package mounts on the instrument panel of the ship.

Radio Compass—ADF

In fair weather or foul the radio compass is an important aid to navigation. With it the pilot may tune in a known station and his radio compass will present a needle indication giving him the relative bearing of the station from the azimuth of his ship. By keeping the needle on the zero mark he may home in on his destination and greatly simplify navigation. On long flights he can determine his exact location by taking a "fix" on two or more stations with his radio compass and then plotting the bearings on a chart. Where the bearings intercept there is his position.

The radio compass is not a new idea. It has been used by ships at sea for many years and a version of it appeared in the early, low-frequency radio systems. This consisted of a loop of wire strung inside the fabric fuselage. In order to obtain a bearing the pilot would fly his ship to get an aural null. This would indicate that the station was facing a broad side of the loop and a signal was being induced into each leg of the loop, out-of-phase, cancelling each other. By obtaining this null point the pilot knew his heading was either directly toward or directly away from the station. To determine which, he had to take two bearings on the same station. First he would obtain his null on a known station then he would make a 90° turn and fly tangent to the course for a few minutes. Then he would turn back toward the original heading and seek his null point again. By observing the change in his magnetic bearing he could determine the true null and the direction of the station. To eliminate this time-consuming procedure the manual loop antenna was produced and added to the low-frequency system. Instead of turning the airplane the pilot needed only to turn the loop antenna. Radio compasses of today offer a completely automatic loop that uses a "sense" antenna to distinguish between the true and false null. The heart of the automatic direction finder is this ability to give only one true null point for a received station. This is accomplished by using the signal received on the sense antenna as a reference point to which the signals from the loop are compared.

The signal received on the loop antenna is 90° out-of-phase with the signal received on the sense antenna and leads or lags the sense signal depending on position to left or right of true null. In the set this loop signal is retarded another 90°. Consequently, the loop signal will then be either in-phase or 180° out-of-phase with the sense signal. After it is retarded 90° the loop signal is fed to the grids of a dual triode. This is the balanced modulator. The halves of the balanced modulator are fired by an a.c. switching voltage which modulates the in-phase or out-of-phase loop signal. When combined with the signal from the sense antenna the modulated signal is either cancelled or added to the sense signal. There are several means of transmitting this information to the loop motor. There are thyratron systems, saturable-reactor systems, and phase-sensitive motor systems. The simplest is the phase-sensitive motor which reacts to the output of the balanced modulators.

Some of the disadvantages of the radio compass lie in its low operating frequency which is susceptible to a high degree of noise. "Mountain effect" and "cloud effect" are deceptive characteristics of the radio compass whereby it may home on a reflected signal from a mountainside or the ionosphere. If a pilot relaxes his vigilance when using the radio compass he may very well follow a false signal to a serious accident. Another disadvantage of ADF operation is inherent in the concept itself. The radio compass indicates the relative position of the station to the heading of the aircraft. This does not fix the position of the ship along a given line without taking other headings and correlating this information with other instruments. A pilot may know that a station is 30° to port but he cannot know where he may be around the station unless he takes another fix or observes his magnetic compass.

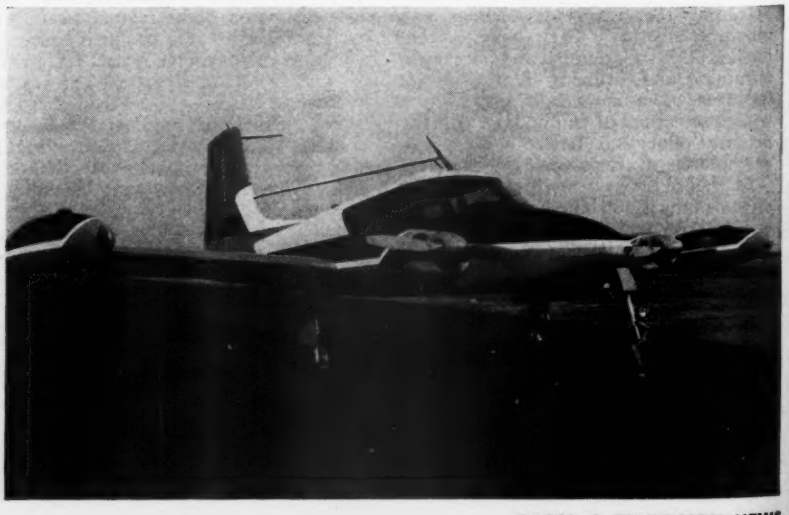
The radio compass automatic direction finder is a useful bit of gear in any aircraft as long as the pilot realizes its limitations and does not try to make the ADF do all his navigating for him.

Omnirange

The omni system works in the 112 mc. to 118 mc. region and, therefore has all the advantages of v.h.f. It is noise free and much less susceptible to mountain effect. Since omni is above the zone of ionospheric reflection there is no trouble from that source. In addition the omni signal gives the pilot considerable information about his position relative to the ground station. There are now more than 375 omni stations throughout the country and more appropriations have been released for further construction. This makes it possible to fly from almost any point in the U. S. to any other point solely on omni navigation.

The omnirange system works on the composite signal principle. The v.h.f. carrier is amplitude modulated with a 9960 cps signal which is usually detected in existing v.h.f. receivers and fed to a separate unit, the omni converter. Impressed on the 9960 cps subcarrier are two 30 cps signals that owe their phase relationship to their compass position from the omni transmitter. One 30 cps signal is the reference signal which is of constant phase about the transmitter. The other is a variable phase signal. This signal is created by a slotted, revolving cylinder about the transmitting antenna which frequency modulates the radiated signal. This signal, then, is the means whereby the omni information is obtained. At 0°, or magnetic north, from the omni transmitter the variable 30 cps signal is exactly in-phase with the 30 cps reference signal. As a circle is transcribed about the transmitting antenna, the variable phase signal begins

Twin Cessna 310 showing "V" shaped dipole on top of vertical stabilizer for v.h.f. reception of omnirange signals. Mast on top is for v.h.f. transmitter and fixed wire from mast to the stabilizer is for low-frequency reception of transmissions.



to move out-of-phase with the reference, due to the action of the revolving drum. At 90° magnetic bearing from the omni station the variable phase signal is 90° out-of-phase with the reference signal. At 180° magnetic bearing it is 180° out-of-phase and so on around the points of the compass. This is the equivalent of radiants progressing from the center of an imaginary circle into space. Each radiant is of a different characteristic which identifies magnetic direction. This gives the pilot a ready indication of his direction and relative position to a fixed point on the ground.

Omnirange installations in small aircraft can be identified by the horizontally polarized dipole antenna usually projecting from the top of the vertical stabilizer or under the tail. Some omni systems employ a scope mounted on the instrument panel. The face of the scope has a calibrated circle marked off in degrees of the compass. When the omni signal is received the electron gun in the CRT traces a circle coincident with the one scribed on the face. The directional indication is represented by a small pip along the circular trace.

Instrument Landing Systems

The approach to every major airport has a system of instrument landing by the use of radio beams. These consist of the glidepath beam, the localizer beam, and the marker beacon. The marker beacon consists of an outer and inner marker which indicates the distance to the end of the runway. It is used in conjunction with the localizer and glidepath to properly position the ship prior to let down.

The principle of operation of the localizer and glidepath is basically the same. The localizer operates on a carrier of 108.3 mc. to 110.3 mc. The left side of the approach is amplitude modulated with 90 cps and the right side is modulated with 150 cps. The carrier frequency is received in existing v.h.f. receivers and detected. This detected signal is then applied to the ILS unit which contains two bandpass filters and a system of rectification. The detected signal is applied to both filters, one of which is tuned to 150 cps and the other to 90 cps. If the aircraft is to the left of the center approach, then the 90 cps signal will be admitted by the 90 cps filter, rectified, and the subsequent d.c. component will be applied to the vertical needle in the ILS indicator. The glideslope operates in the same manner with 90 cps above the glidepath and 150 cps below the glidepath center. As long as the aircraft is following the center line between the localizer and glidepath beams, equal d.c. signals will be applied to a vertical and horizontal needle in the ILS indicator. The needles will then be centered and indicate that the ship is "on the beam."

Automatic Pilot

An aircraft has three axes of motion; roll, pitch, and yaw. In small aircraft every slight air current tends to deter the plane from its on-course straight and level flight. Because of this the pilot is working continuously to keep his aircraft on course and in the proper attitude. It is obvious that if he must spend all his time flying the airplane he is left little time for navigation and less to enjoy the ride. This also induces "flight fatigue" which is a serious deterrent to maintaining safety on long flights. For these reasons there have been a number of autopilots and partial autopilots put on the market for small aircraft. They range from simple, single-axis rudder controls to complete, three-axis autopilots that even have an approach coupler to follow the ILS beam automatically!

Basically, all autopilot systems employ three devices, the sensing element such as a gyro with a *pick-off* system, an amplifier which amplifies and analyzes the "signal" from the gyro pick-off, and a *servo* system that translates the analysis of the amplifier into mechanical efforts on the aircraft control surfaces to return the ship to its on-course attitude. When the autopilot is engaged the human pilot may tend to his navigation or just sit back and relax because the autopilot can make minute corrections in his course faster than he can detect them. The result is a smooth, level flight, on course, without flight fatigue.

There are several refinements to the basic autopilot system just described that go a long way toward perfecting the system. One of these refinements is the *follow-up*. The follow-up acts as an artificial "spring" to help keep the plane from overshooting the course when the autopilot acts to correct errors. The follow-up is connected to the control surface of the aircraft and gives negative feedback into the amplifier. This produces a closed loop system to dampen the action of correction so the aircraft will not oscillate about the on-course line.

Another refinement in the basic autopilot concept is the *rate network*. This is an *RC* bridge that develops the *change* of the sensing device across a resistor. The output of the sensing device determines that the aircraft has left its on-course attitude, how far the ship is off course, and in which direction. The rate network determines the rate of departure from the course and gives additional energy to the correction system proportional to the rate of departure. Likewise it determines the negative rate when the aircraft returns to its course and helps the follow-up dampen the return to on-course position. Some systems have an altimeter working in conjunction with the autopilot to maintain a constant altitude as well as constant attitude.

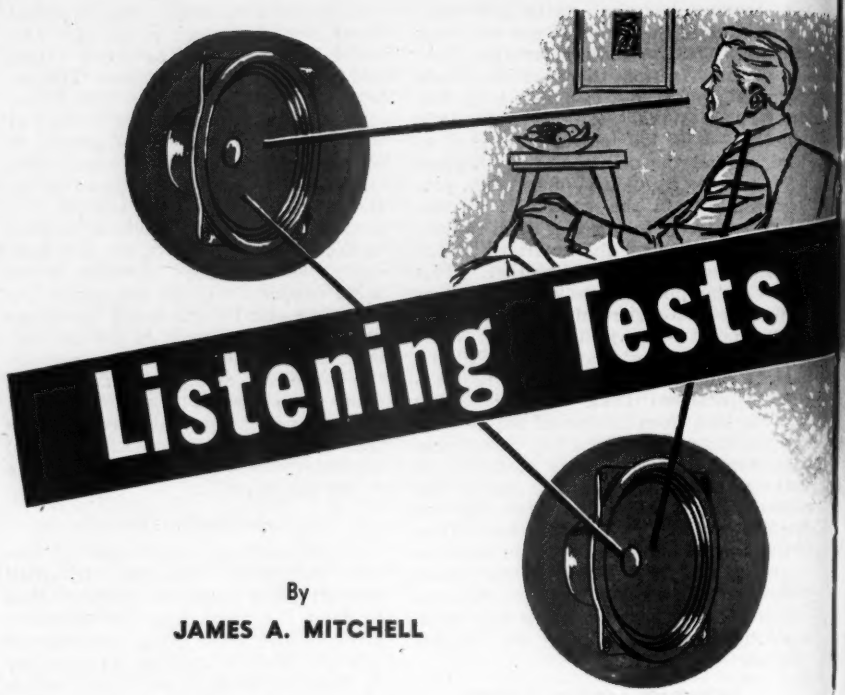
Automatic Propeller Control

Many of the functions once performed by mechanical means are now done electronically because of cost, efficiency, and adaptability to small aircraft needs. In some of the more elaborate small aircraft an electronic device is employed to control the speed of the propeller and thereby gain maximum performance from the powerplant of the ship. This device has a sensing element in the nature of a spinning magnet that is coupled directly to the propeller. The speed of the magnet exerts force on an iron vane to keep it in a neutral position. Since the vane is spring loaded it will deflect in one direction if the magnet slows down and will deflect in an opposite direction when the spinning magnet speeds up because of the increased magnetic pull exerted upon it. The vane is positioned in such a manner so that it covers the orifice to two photocells when it is in the neutral position. If it deflects in either direction, one of the photocells will be exposed to a small light. This, then, is the sensing element. The signal from the sensing element is fed to an am-

(*Continued on page* 100)

Topside is the fixed wire from mast to tail for the low-frequency receiver. Midwing is the whip antenna for v.h.f. transmitter and omni-dipole is extended from top of tail. Fixed wire on the bottom is for the reception of marker beacon transmissions.

Listening Tests



By
JAMES A. MITCHELL

If you have a good ear or are musically trained and know how a musical selection should sound, listening tests are OK, but don't trust them 100% if blessed with a "tin ear".

A GREAT DEAL has happened in the world of high fidelity since the famous *Cinaudagraph* and *Jensen* speakers of the thirties. The growing demand for good sound has spurred the establishment of dozens of new speaker manufacturers and today the hi-fi fan can choose from literally hundreds of speaker models. The purpose of the speakers has not changed however; to convey to *your ear* the impression of a full symphony orchestra or a girl with a song on her lips. It's a tall order and the wonder is that modern speaker systems can come so close to filling the bill.

It will be confirmed by most high-fidelity experts that the selection of the speaker system is the most critical choice in assembling a good hi-fi rig. All of the components are, of course, important but there are more noticeable differences in speaker systems than in the other parts. Unfortunately, no method of measuring the fidelity of a speaker has been devised which will tell how it sounds. Even the experts disagree on the type of sound at which we are aiming. Specification sheets and advertisements cannot describe the sound of a speaker and can actually be misleading.

In general, most newcomers to high fidelity choose their speakers from the most widely advertised and promoted ones. Those with a bit more knowledge often make a choice from specification data or from the principles of engineering used. On the basis of experience, the author maintains that both of these methods can lead to bad selections. Only one method of speaker system selection has proven to be satisfactory. This is the listening test, but even this method can be ambiguous without a little experience.

It is our plan, therefore, to discuss the fundamentals of listening tests to enable you to select a speaker system which will best fit your needs. Now by "the speaker system best fitting your needs" we mean the speaker system which within your space and budget limitations will give you the most satisfying reproduction of music in your home over a long period of time. Since different people have different ideas of how music sounds or how it should sound, there will naturally be differences of opinion about speakers. However, a good listening plan will enable each type of listener to find the speaker which will satisfy him.

About Listening Tests

Our perception is such that differences in sound are best observed by an instantaneous switch from one speaker to another. Most of the audio equipment salons are set up to make such *A-B* comparisons. Under proper conditions these tests can be most revealing. Listening at a friend's home can also be valuable as the longer listening periods and home acoustics help you imagine the same speaker in your home.

The most pleasant sounding speaker system, in the long run, is generally one that is the most natural or realistic. For this reason it is well for the prospective speaker buyer to educate his ear on "live" sound. If you have done most of your listening to records or radio, go to a few concerts. Listen to a symphony orchestra, a violinist, a soprano, a jazz band. Imagine the sound in your home which would give the best illusion of the real thing. Remember this when comparing speakers.

The more experience you have in listening the better you are able to select a satisfactory system. If you are a newcomer to high fidelity you may profitably buy a speaker in the lower priced brackets first; then after your tastes have matured, select a better and more expensive unit. Learning how to pick a speaker system which will satisfy you for a long period of time takes some perception, but it can be done. This is not all a matter of paying a lot of money for a speaker system. There are some excellent moderately priced units which will meet the needs of the sophisticated listener, and there are some high priced systems which can set you on edge after a period of listening.

There are a number of points about listening tests which should be kept in mind if we are to gain the correct impression. The source of the sound used in the test is most important. Some records can cause very misleading results. A record with considerable distortion at the very high frequencies can make the speaker with the poorest high-frequency response sound the most distortion free. Other sources of confusion are discs containing rumble, buzz, transient distortion, and unnatural or overemphasized effects. A bad record doesn't sound good over a good speaker; a poor speaker may mask some of the distortion on the record. It is a good plan, therefore, to do your comparative listening using records you know to be good. The author believes that comparative speaker tests should be run using the best quality records available. Records will probably keep improving after you buy your speaker. Old and distorted records can best be handled by tone controls and cut-off filters, not by buying limited range speakers. The author recommends that you use some of your own records for listening tests. A few well chosen ones will be all you need and you will have the advantage of being thoroughly familiar with them.

It is also important that the rest of the equipment used in the sound comparison test be in good condition and properly adjusted. A worn pickup stylus can upset any listening demonstration. Make sure that the preamplifier-equalizer settings are the correct ones for the records used. It is also desirable to start the listening tests with the tone controls set at flat response. Also make sure that the loudness compensation is switched out. Tests conducted with the loudness compensation on can be very ambig-

uous since you are never sure of the amount of bass and treble boost especially when the volume control position is changed. As far as the choice of specific pickups, preamps, and amplifiers for speaker demonstration is concerned, there are two theories. One is to use the same equipment up to the speaker as you are now using or planning to buy. The other plan is to use the best equipment available. Either method is OK but the latter may be preferred if you plan to upgrade your equipment progressively.

The audio demonstrator has a problem in conducting *A-B* speaker tests when the two speakers have different efficiencies (which is nearly always the case). It is universally agreed that in order to compare speakers they should be heard at the same loudness level as they are switched back and forth in the *A-B* test. Our hearing is such that we are led to believe that the louder of two sources has more bass, is more brilliant, and has less distortion when they are, in fact, the same. This can cause confusion in any listening comparison depending on how the problem is handled. Some audio showrooms use attenuators between the amplifier and the speakers to adjust all of them to the same loudness. Others feed the speakers directly and let the loudness vary with the speaker's efficiency. While the use of attenuators solves the problem of changes in loudness, it introduces a difficulty of its own. Attenuators between the amplifier and speaker change the damping factor of the amplifier as seen by the speaker. Changing this damping factor, or source impedance, changes the frequency response of the speaker (especially in the low bass) and the damping characteristics (trancient response) of some speakers. To be fair, speaker systems should be compared using the same amplifier damping factor or, to be even more correct, the *A-B* test should be conducted switching between two identical amplifiers each adjusted to the optimum damping factor for the speaker with which it is used. This complication is really necessary only for a few speakers. The author prefers the method where no efficiency corrections are built in, as this gives you a chance to learn what differences in speaker efficiency really exist. In making an *A-B* test, twist the volume control as the speaker switch is flipped to get the same loudness from the two speakers. A few trials show how.

Another problem in making speaker comparison tests is created because the unit is housed in the wrong type of cabinet or enclosure. It should be emphasized that the enclosure or baffle for the speaker is as important as the speaker itself in determining the quality of the sound. You will note that we have been talking about *speaker systems* rather than just loudspeakers. By a "speaker system" we mean a speaker or set of speakers in a complete mounting or enclosure. The whole system must be considered as a unit when talking about the ability of a speaker to reproduce musical quality faithfully. To give a fair listening comparison a speaker should be tested in the enclosure recommended by the manufacturer. Be wary of judging a speaker of one brand which is demonstrated in an enclosure designed for a different speaker. Sometimes these mixed systems work out well but more often they do not. It is common practice in many audio showrooms to mount a group of 10 to 20 speakers in a wall for listening comparison. While this has the advantage of allowing the comparison of a lot of speakers, it may be a bad setup for running a really definitive test. If the units are all mounted on the same board without separating partitions between them, there may be serious interaction between some of the units. The position of the speaker on the wall will greatly influence the bass response. If the speakers are each in small boxes with bass reflex ports, the cabinets are probably not properly adjusted for each speaker. Then, too, some speakers are definitely not designed for bass reflex mounting. If the speakers are mounted in closed boxes of reasonable size with rugged construction and with good acoustical padding, the setup may be regarded as a reasonable compromise between compactness and fair comparison. The high-frequency and mid-range tones of the speakers can be fairly judged under these conditions. The low bass range can be quite different in a properly matched enclosure and this should be constantly kept in mind. Preliminary comparisons can thus be made on this type of setup but for final choice always insist on hearing the speaker in the enclosure which you intend to buy. Remember it is the sound of the speaker *system* to which you will listen.

Choosing a System

If you are a novice at this hi-fi business, it is suggested that you visit an audio sales showroom. Discuss your installation with the salesman and get a general picture of what he has to offer and the type of listening facilities available. Listen a little if you wish but don't decide on the first visit. Make an appointment to come back when you can bring your own records and listen for an hour or so. Most audio salesmen are anxious to help you find the speaker which best suits your ear and will be glad to work with you.

A good way to start the listening comparisons is with a wide-range, low-distortion symphonic orchestra disc. The music at the start of *RCA Victor's* "An Adventure in High Fidelity" (LM 1802) is a good example for this test. So is *Westminster's* "Sailor's Dance" from "The Red Poppy" (WL 7001). If you prefer jazz, try the Ray Anthony "Sound Off March" on *Capitol* LAL-9022. Listen for over-all naturalness of sound. Are the high notes clear but not overemphasized? Can you hear the shimmer of the triangle free from buzz? Note if the mid-range instruments (trumpets, cellos, clarinets) are full bodied and real in sound, while remaining separate and distinct. Listen for the bass response of bass viol, organ, tuba, and tympani. These instruments should be clearly reproduced with good volume by the speaker system while maintaining the character of each. Beware the "boomp-whoomp" quality of loud but muddy one note bass. Be careful not to mistake excessive brilliance for clarity. It's easy to build a tweeter which will give cymbals more clash than they really have. Such a speaker may amaze you at first, but listen longer and keep the sound of that live symphony orchestra in mind.

Compare the speaker's performance at low- and high-volume levels. Listen to the differences in clarity as the music hits volume peaks at loud levels. Then turn the volume down to a quiet living room level. Note which speakers change the least in tone color with this change in volume. Many speakers have a tendency to sound as if they lose uniformity of frequency response at fairly quiet volume levels. Low volume listening quality is very important in a speaker for home use. It takes a good speaker to sound full and

(*Continued on page* 160)

Hoffman "Colorcasters" for 1957

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS

Owner appeal, convenient operation, and quality performance are the goals of this manufacturer.

ONE enthusiastic manufacturer of color TV receivers, *Hoffman Electronics Corp.*, is now featuring its third series of color models. The first two were the 15- and 19-inch shadow-mask tube versions of several years ago; the latest series of receivers uses the 21AXP22 exclusively. This tube is the round metal envelope improved shadow-mask version used in *RCA, Emerson,* and many other late-model color sets. In all *Hoffman* "Colorcasters" the picture tube is mounted in the cabinet and shipped in place.

Four basic receiver models comprise the new "Colorcaster" line, each available in mahogany, limed oak, and Salem maple veneers with prices varying according to the type of finish. Basically equipped with a v.h.f. tuner, each receiver is also furnished for full 82-channel reception at a slight increase in price. When a u.h.f. tuner is included, the model number remains the same but with the letter "U" added.

The lowest priced model is the "Commodore," a table model costing from $595 to $645, depending on the finish and whether or not it includes a u.h.f. tuner. The "General" is an open-faced console with the speaker panel below the screen; while the "Ambassador" is a lowboy style cabinet with the speaker mounted alongside the picture tube. An elaborate three-speaker sound system is used in the most expensive model, the "President." Table 1 lists the recommended retail prices on the *Hoffman* color line.

Like some of the new *RCA* color receivers, the *Hoffman* "Colorcasters," with the exception of the "President" model, have the station selector and "on-off"-volume control at the upper side panel. The "President" has all controls on a vertical front panel alongside the screen. An unusual and novel feature is the addition of color dials to the hue and chroma-gain controls. As indicated in Fig. 1, the hue control background dial has a red and green section at the sides with a flesh color setting in the center. This helps the customer to remember that, by turning the knob to the right, greenish hues will predominate, while turning it to the left will increase the emphasis on the reds. The correct position of the hue control is indicated in the viewed picture by the naturalness of the flesh colors. When the flesh tones in the picture appear too reddish, the customer will have no difficulty in deciding in which direction the hue control should be turned.

The action of the chroma gain or "color brilliance" control is made graphic as well. Three color stripes, which taper from the weakest chroma gain to the saturation point where the stripes are thickest, are shown in Fig. 1. This clever use of human engineering in illustrating the purpose and action of the hue and chroma controls should avoid many service calls due to customer misunderstanding.

Another control that is not found in many other color receivers is the "Town and Country" switch included in every model. The action of this switch is basically the same as the "local-distance" switch used in many familiar monochrome TV receivers. Its presence in a color set, however, is new and will be a considerable help in locations of either excessive signal strength or in fringe areas.

In the "President" model, the chassis is mounted on its side, with the tubes pointing toward the picture tube and the bottom of the chassis accessible when the side panel of the cabinet is removed. The other three models have the chassis mounted underneath the picture tube, but with the feature that the entire chassis slides out at the rear for easy servicing. In addition to the customer-operated controls, almost all of the other adjustments are located under the removable small subpanel below the screen. These controls, together with some adjustments accessible from the rear of the receiver, permit the service technician to adjust for optimum monochrome and color performance.

Service and Installation

Hoffman's policy is that TV receiver installation and all service is the function of its distributors and dealers. Detailed service bulletins, as well as con-

siderable basic instruction in color TV, have been furnished by the factory and, in addition, each receiver is supplied with a diagram (complete with frequencies, voltages, and waveforms) fastened on the inside of the cabinet.

The standard warranty for one full year on the picture tube and 90 days on all parts is provided by the manufacturer. Regular installation and service contracts are available from local dealers. Prices of these service contracts depend on the individual store and local labor charges.

Each "Colorcaster" is shipped complete and ready to operate but the average purchaser will still require an expert to install the set. Aside from the availability of a usable antenna, the color purity, convergence, and synchronizing controls almost invariably require adjustment.

NAME	MODEL NO.	TYPE	SCREEN SIZE*	FINISH	PRICE**
Commodore	M2021	Table	21"	Mahogany	$595.00
	B2021	Table	21"	Limed Oak	615.00
	P2021	Table	21"	Salem Maple	615.00
General	M4041	Console	21"	Mahogany	695.00
	B4041	Console	21"	Limed Oak	715.00
	P4041	Console	21"	Salem Maple	715.00
Ambassador	M4061	Lowboy	21"	Mahogany	775.00
	B4061	Lowboy	21"	Limed Oak	795.00
	P4061	Lowboy	21"	Salem Maple	795.00
President	M4021	"Soundorama" Console	21"	Mahogany	795.00
	B4021	"Soundorama" Console	21"	Limed Oak	815.00
	P4021	"Soundorama" Console	21"	Salem Maple	815.00

*Diagonal measurement.
**Price is suggested retail for manufacturer's local zone (with tax) on v.h.f. models. The u.h.f. models are from $20 to $30 higher.

Table 1. The current line of Hoffman "Colorcasters" includes four basic models, available in a choice of three different wood finishes, from $595 to over $800.

Circuit Features

All of the *Hoffman* color receivers use basically the same receiver chassis with only minor modifications, usually involving the number of speakers, u.h.f. tuner, etc. This chassis employs circuitry described in detail in the September 1956 issue of this magazine and is quite similar to the *RCA Victor* receiver described in the March 1955 issue. One of the outstanding differences is in the action of the contrast and chroma-gain controls. By coupling these two controls together and by some modifications in the video circuitry, the usual problem of balancing out contrast with chroma gain is eliminated. Whenever the contrast control setting is changed, a corresponding change takes place in the chroma section with the result that color and *Y*-signal gain track closely.

Other features include the use of a synchroguide horizontal oscillator and a.f.c. stage, instead of the familiar multivibrator circuit. Also, in the interests of producing a quality image, there have been alterations in the color producing portions of the receiver circuit.

Revisions in the latter direction are concerned mainly with providing wider bandpass in the color-signal circuits. As an example, two stages of bandpass amplification now precede the color demodulator circuits, where one was used before.

Also, the widely adopted high-level narrow-band triode demodulators have been abandoned in favor of low-level wide-band stages. The receivers use a pair of color detector stages identified as the *X* demodulator and the *Z* demodulator. The *X* demodulator feeds to the grid of the *R-Y* amplifier, while output from the *Z* demodulator is applied to the *B-Y* amplifier. The *G-Y* signal is produced from the mixed *R-Y* and *B-Y* signals.

Another alteration is intended to facilitate balancing out the outputs of the three guns in the picture tube. In earlier receivers, separate controls were provided for the blue and green guns, but none for the red gun. Balance was achieved by manipulating the blue and green controls along with the master brilliance control, which affected output of all three guns simultaneously. The present arrangement is easier to adjust: there are separate controls for the red, green, and blue guns on the latest "Colorcasters."

For the rest, circuit design and layout do not present any radical departures from the color sets of other manufacturers.

Since installation and service are not under direct control of the manufacturer, with policy being determined locally by distributors, there is no set pattern as to whether the distributor's service personnel or that of the dealer will be responsible for the receivers after they are in the hands of their owners. Nor is there any pattern evident as to whether the receivers will be serviced on an individual-call or contract basis and, if the latter policy is to prevail, what the cost of the contracts will be. With this uncertainly, the set maker has apparently felt obligated to make available the best possible data for use by whomever will be called on to work on the sets. The well-illustrated service booklets on the "Colorcaster" chassis give complete and detailed instructions on procedure and adjustment.

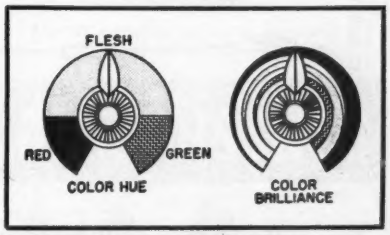
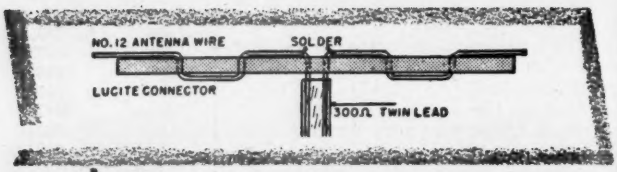


Fig. 1. Use of actual colors on the color hue and color brilliance controls is to make their functions graphic to the technically uninitiated. Note taper of the three color stripes around the color brilliance knob, to indicate range from pastel shades to saturated shades.

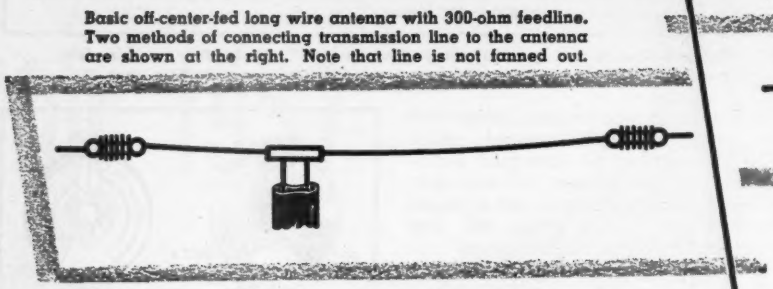
At the time this article was prepared, *Hoffman* had scheduled full production of all the models discussed here. Plans call for the marketing of this color line throughout the 1956-57 business year. Additional models may be released as required but the main line has been planned for current availability. —30—

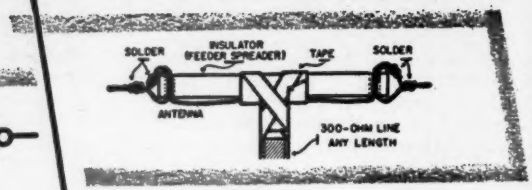
The "Ambassador," lowboy model available in choice of three finishes, is made to sell for under $800. Note station selector and on-off-volume control on upper side panel, while other controls are under the picture tube, located on the horizontal chassis.

Off-Center-Fed ANTENNA DESIGN



Basic off-center-fed long wire antenna with 300-ohm feedline. Two methods of connecting transmission line to the antenna are shown at the right. Note that line is not fanned out.





Details on a multiband antenna which is especially useful in locations where only one array is possible.

By **WILLIAM O. HAMLIN, W1MCA**
Supervisor, Technical Information Service
CBS-Hytron, Division of CBS, Inc.

THE off-center-fed antenna is a convenient type to use for multiband operation under conditions where it is impractical to have a separate antenna for each band and a non-resonant feeder is desired. It should be understood that this is not a cure-all antenna and its operation must be studied if the most satisfactory results are to be obtained.

This antenna has shown some popularity in the last few years because of the desire of many amateurs to change bands with their "Viking" or *Collins* 32V series transmitters without changing antennas. By using the proper matching networks, such as balun coils or antenna tuner, the off-center-fed antennas will load up easily.

The frequencies at the low end of each short-wave amateur band are harmonically related to each other, except for 160 meters, yet the resonant frequencies of a piece of wire are not. To be resonant for a certain frequency, a piece of wire is shorter than the wavelength of the frequency in space due to the end effect (loading caused by the added capacity of the insulators and tie loop). The wire is about 5% less, which may be written:

$$L = 492(N - .05)/f$$

where:

L = length of wire in feet
N = number of half wavelengths
f = frequency in megacycles

If the length is interchanged with frequency in the formula it is readily seen that the resonant frequencies are not harmonically related by the factor $(N - .05)$. Table 1 has been worked out to aid in choosing the most desired frequencies in multiband operation.

Generally, the ten-meter frequency that is to be used is the first consideration because the resonant length is more critical at the higher order of harmonics. If ten meters is not to be used, it would be more advantageous to cut the antenna for the high end of twenty meters.

Feeder Point Connection

If the impedance of a long wire is plotted on semilog paper at even multiples of a half wavelength, it will be found that some 300-ohm points scatter fairly closely about the same point on the wire. They do not coincide exactly because the current node radiation resistance varies with the number of half wavelengths the wire represents. The radiation resistance of one half wavelength approximates 70

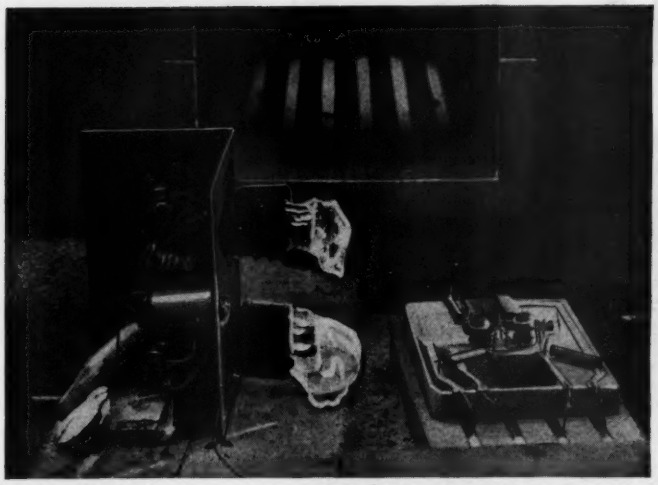
(*Continued on page* 150)

Table 1. Various harmonic frequency combinations are shown here for multiband ham operations with 80 and 40 meter fundamentals.

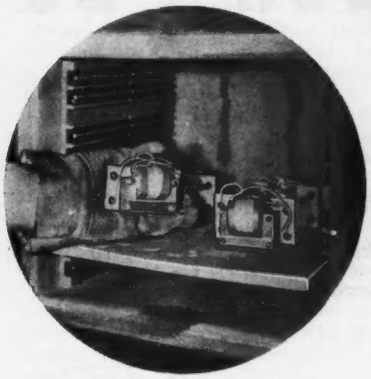
Length (ft.)	Frequencies (in mc.) for following wavelengths ½	1	2	4
	80-METER FUNDAMENTAL			
138	3.39	6.95	14.1	28.4
137	3.41	7.0	14.2	28.6
136	3.44	7.05	14.3	28.8
135	3.46	7.1	14.4	29
134	3.49	7.15	14.5	29.2
133	3.52	7.21	14.6	29.4
132	3.54	7.26	14.7	29.6
131	3.57	7.32		
130	3.6	7.38		
128	3.65			
126	3.71			
124	3.77			
	40-METER FUNDAMENTAL			
68.5	6.84	14.0	28.4	
68	6.88	14.1	28.8	
67.5	6.93	14.2	28.8	
67	6.98	14.3	29.0	
66.5	7.04	14.4	29.2	
66	7.09	14.5	29.5	
65.5	7.15			
65	7.2			
64.5	7.26			

Table 2. Close impedance matching to 300 ohms on multiband antenna in the clear. Connection point at .325 length on 1st, 2nd, and 8th harmonics and .34 length on the 4th harmonic.

ANTENNA LENGTH (ft.)	BAND	CONNECTION POINT FROM END (in ft.)
137	80-40-10	44.5
	20	46.5
135	80-40-10	43.9
	20	46
133	80-40-10	43.25
	20	45.25
131	80-40	42.6
68.5	40-20	22.5
	10	23.25
67.5	40-20	21.9
	10	23
66.5	40-20	21.6
	10	22.6



Ordinary and new high-temperature circuits after being exposed to 1500 degree F. heat.



Special transformers have been run for long periods in electric ovens.

Red Hot Components for Guided Missiles

Special electronic components developed by G-E can operate reliably at high temperatures and withstand large amounts of nuclear radiation.

Type of electronic assembly subjected to radiation tests in Oak Ridge reactor.

THE penetration of a critical temperature barrier in the development of guided missiles and supersonic aircraft was dramatically demonstrated recently when *General Electric* scientists exhibited laboratory models of revolutionary electronic devices and circuits operating literally "red hot." The achievement was described as a major step toward overcoming the inability of electronic controls to withstand the skin-sizzling heat generated by air friction at extreme speeds.

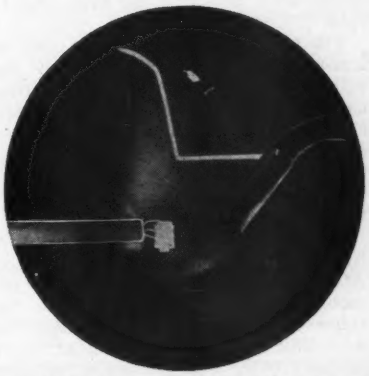
An equally important "plus" feature of the new electronic circuits is their ability to operate for long periods while exposed to nuclear radiation.

Tremendous defense implications were attributed to the heat-resistant, radiation-tolerant electronic tubes, resistors, capacitors, coils, transformers, wiring, and circuit boards. Radically new concepts in these components and circuits represent a breakthrough in the "thermal barrier" and give new impetus to the nation's guided missile, satellite, and supersonic plane programs. Among the advantages predicted are extensive weight reductions made possible by elimination of bulky, power-consuming cooling equipment from missiles and aircraft.

Military demands of World War II resulted in the development of several components that would operate at 300 degrees F., but the over-all reliability limit was, and in much of present-day equipment still is, about 200 degrees F. The recent emphasis on guided missiles and supersonic aircraft has greatly increased the requirements, but until now extensive research and expenditure has produced only a few components capable of operation at 500 to 600 degrees F. The components and circuits shown here are capable of proper and reliable operation in the temperature range of 900 to 1500 degrees F. At these elevated temperatures ordinary electronic assemblies would stop working and actually melt into a puddle of metal and glass.

Guided missiles are one of the most challenging applications of high-temperature components, which must operate reliably in two sources of heat: internal and external. The high internal heat is the result of a large number of electronic components that must be jam-packed into an absolutely minimum volume for weight and space reduction. For example, an air-to-air missile requires a relatively elaborate guidance and control system that is within a cubic volume not much larger than that of a basketball. With all the components operating, compartment temperature may increase several hundred degrees so as to cause faulty operation or outright failure.

The intercontinental ballistic missile (ICBM) is a classic example of an application of high temperature components to the problem of external heating. The ICBM must descend from extreme altitudes at velocities of about 10,000 mph and re-enter the dense layer of air surrounding the earth. Within this envelope of air, friction between the ICBM and the air around it generates heat equal to the heat generated by a half dozen or more of the world's largest steam turbines. If not dissipated, this heat rise can make ICBM electronic components either malfunction or fail. -30-



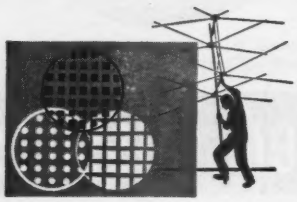
Ceramic tube operates—shown by scope pattern—even when glowing in blowtorch flame.

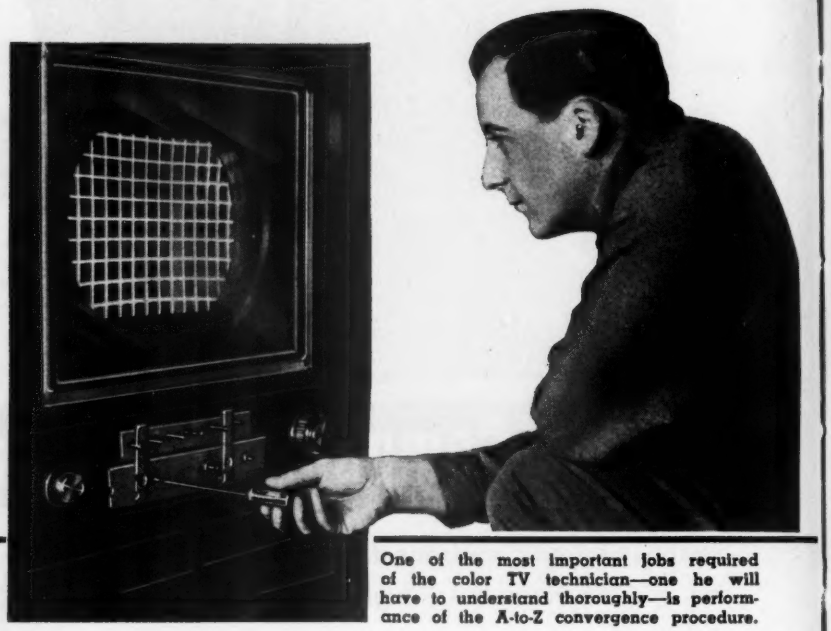
This special motor can be operated so hot that a cigarette may be lit on its housing.

Don't Be Afraid of Color TV

By **ART MARGOLIS**

Many troubles resemble those in black-and-white sets; others start to become familiar quickly.





One of the most important jobs required of the color TV technician—one he will have to understand thoroughly—is performance of the A-to-Z convergence procedure.

THE service call was timed perfectly. The setting up and convergence of the new 21-inch *RCA* color receiver had been completed a good ten minutes before the colorcast was scheduled to start. The set owner, a new car dealer, perched on the edge of his chair awaiting his first look at color TV.

The pre-show time was consumed by last-minute chores—packing up the test equipment and closing the tube caddy. Then, on the screen, the MC entered through parted curtains and announced, "You are now watching color TV." The program may have been transmitted in color but there was no rainbow on the screen!

The color and hue controls were turned all the way up—still no color. A cursory inspection revealed no obvious source of the trouble so the tubes were checked. After about the fifth tube substitution, the light began to dawn. Why was there no color when the dot-bar generator produced beautiful hues on the screen? The only difference between the two set-ups was the outdoor antenna! A hastily procured rabbit ears solved the problem long enough to avert a heart attack by the owner until the rooftop antenna could be inspected.

Finding the lightning arrester burned and shorted, this was replaced and the color flowed over the screen. Evidently the lightning arrester had been faulty for some time but in this prime signal location its absence was of no importance to monochrome reception but it made a vast difference where color was concerned.

Service technicians approaching color television for the first time are more or less faced with the same problems the old timers tackled when black-and-white first came on the scene. There is one redeeming feature, however, and that is that those who have coped with monochrome sets will find that color troubles fall into similar categories. There are the obvious tube replacements and adjustments to be made. Then there are some hard-to-figure symptoms that ultimately resolve themselves into tube changes and adjustments. There are the normal bench-type repairs and, inevitably, the familiar "dogs" and intermittents.

One great difference in the two types of service is in the importance of the role played by the antenna. Antennas that are performing well on monochrome may not work satisfactorily for colorcasts. Of the twenty-two color service calls handled by the author thus far, ten involved tube replacements, two called for adjustments of various types, five were antenna jobs, and five involved bench-type repairs. Although no real conclusions can be drawn from this breakdown, it does indicate some sort of a trend.

Monochrome Experience Helps

Color TV today stands on familiar ground. Most of the circuitry and many of the troubles are the same as for monochrome. In many instances black-and-white servicing experience will prove adequate.

For example, the author was called upon to service a 15-inch set that had snowy pictures. Although it was "Technicolor" snow, there was no mistaking the familiar flakes. The 6BQ7 r.f. amplifier tube had shorted and burned out two resistors in the tuner. The installation of new resistors and a tube replacement set things aright.

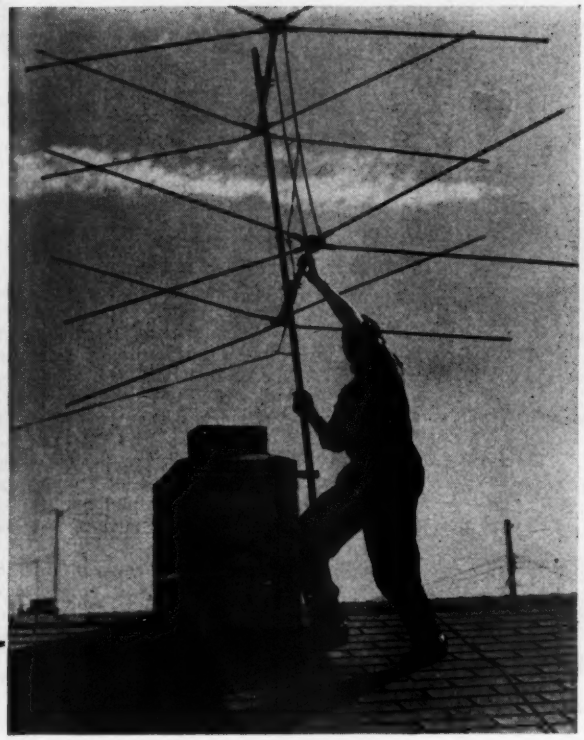
Another 15-inch set brought the familiar "no raster but sound" complaint. Like its monochrome counterpart, the high voltage rectifier was cracked, killing the high voltage. A 21-inch set whose owner reported raster but no sound or video turned out to be a simple case of a burned out 6AQ5 audio output amplifier tube. It killed the video, too, for the screen of the 3rd i.f. draws "B+" from the 6AQ5's cathode circuit.

On another 21-inch set where the strong stations blacked out and the weak ones trickled in, the 6U8 a.g.c. amplifier tube proved defective—just as it might in a monochrome receiver.

Another "case" which required a slight variation in black-and-white theory involved a report that the picture disappeared only during commercials! The program was received OK but when the commercial came on the picture bloomed, defocused, deconverged into a rainbow of colors, and then disappeared. At the end of the commercial, the program came back in fine shape.

A decrease in the high voltage appeared to be the trouble so the rectifiers were checked first—to no avail. A new 6BD4 high voltage regulator tube was installed and that did the trick. The commercial held firm. It seems that when a high level of white is sent into the tri-color tube, as during the commercials, the CRT draws more current. The high voltage regulator tube is supposed to allow more current to be drawn without a drop in high voltage. With the tube defective, as the current was drawn the high voltage decreased and the multicolor blooming occurred.

While the service jobs thus far cited



Even an antenna that is adequate for color reception may have to be reoriented for optimum performance.

needed no more than normal black-and-white theory plus common sense, some troubleshooting chores involve a thorough understanding of theory.

To demonstrate this point, take the case of the set where the top half of the picture was blue with retrace lines, the bottom yellow. The first step was to adjust the color gun controls. This operation resulted in the blue changing to black and the yellow to near-white. The reason was obvious. This was a classic case of 60-cycle hum in the video. The r.f. amplifier, a 6BQ7, had a filament-to-cathode short.

Another complaint involved a low brightness level and a brownish picture during a black-and-white transmission. The 6BC7 d.c. restorer was dead.

Another problem which came up about this time involved the color set cited first—the new car dealer of the shorted lightning arrester. Timing the service call for a scheduled colorcast, it was found that only the top few inches of the picture were affected. The top sparkled with all colors, red predominating. The hero of the scene, whose head reached the top of the screen, looked as though his ears were bleeding badly. It was an extreme case of misconvergence at the screen top. A second symptom, the "pointy" head, was a tip off that this was, indeed, a familiar problem. Replacement of the vertical output tube restored the picture. The weak vertical output tube was causing vertical stretching and misconvergence.

Training a Must

With a bit of luck, any TV technician worth his salt could undoubtedly have scraped through all of the cases mentioned so far. However, there are still plenty of color jobs that require formal and thorough color training. For the past year the author's firm has been on active lookout for all the color information and training being offered. All available articles have been studied carefully and the technicians have been attending the *RCA* lectures and taking the *Philco* color course. We have found that certain color jobs require formal training. One absolute "must" for every color technician is complete familiarity with the convergence procedure.

Among the unusual problems that arise in convergence cases are the effect of weak or defective 12BH7 red adder and output tubes, a loose or defective field neutralizing coil, and the misadjustment of the bandpass a.g.c. control. The effect of these components on the color picture would have been lost on a technician unfamiliar with color theory.

Another component, unique with color sets, is the additional oscillator running at 3.58 mc. This may prove to be a headache to technicians. One case involved the hue control which wouldn't permit the color to be turned up bright enough. In order to place this control in the center of its range, it was necessary for the technician to phase align the oscillator. This same symptom on a second set proved to be caused by a bad oscillator tube. So it goes!

Color Antenna Troubles

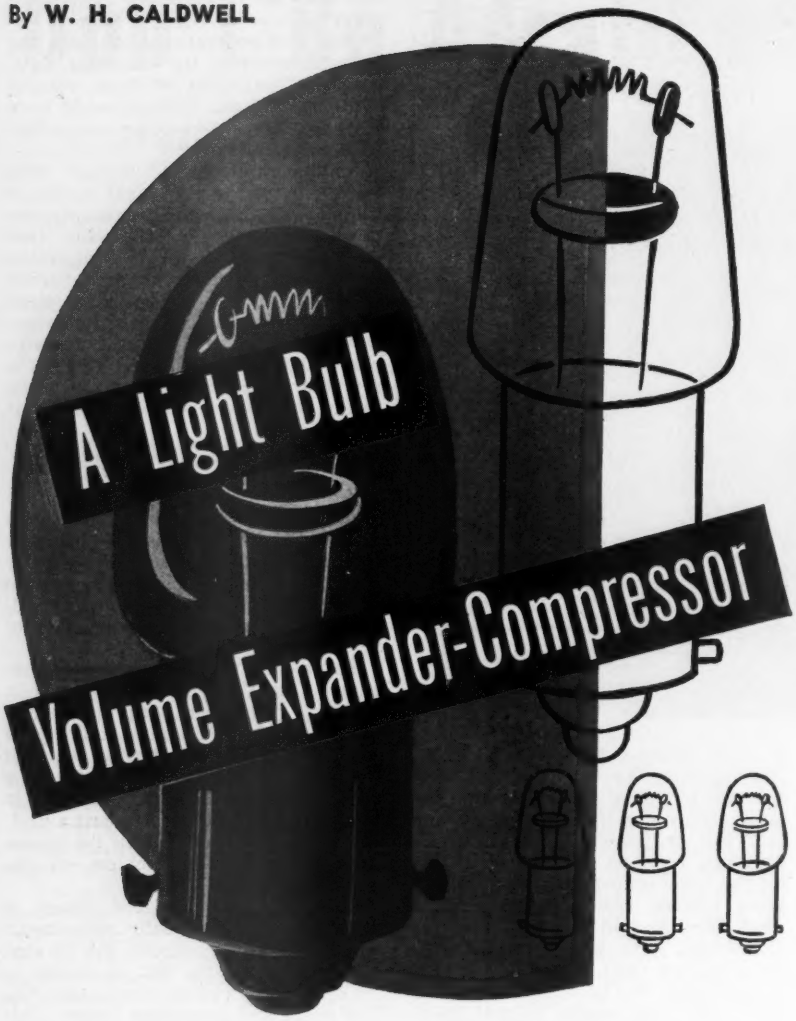
With the advent of colorcasting, antenna orientation troubles have again reared their ugly heads. While many existing installations are OK for color reception, more are going to require work. Antenna rotators will be needed in some locations in order to provide good color reception.

Technicians who thought their problems of ignition interference were a thing of the past with the newer black-and-white circuitry and keyed a.g.c. will be encountering this old bugaboo with color receivers. There is little that the technician can do to eliminate this trouble; it is just a matter of "sitting it out" until the manufacturers whip the problem on the drafting board.

Color TV, like all good things, is here to stay. Eventually refinements will be made, the circuits will be simplified, and repairs will be easier to make. At this pioneer stage, servicing is strange and sometimes rough. This doesn't mean it can't be handled—because, eventually you are the fellow who will have to cope with it. Sooner or later color is your problem—so don't be afraid of color TV. -30-

Circuits may differ—but the technique of changing tubes in an attempt to localize a fault is a familiar procedure that works with any type of equipment.

By **W. H. CALDWELL**



A Light Bulb Volume Expander-Compressor

An inexpensive, easy-to-build gadget which provides added enjoyment when listening to your hi-fi system.

THE volume compressor is useful for reducing the dynamic range of speech or program material. In recording, too large a signal will cut into an adjacent groove, while too small a signal will be lost in the surface noise of the record. With tape, too strong a signal will saturate the tape and may cause "print-through" of a strong passage on an adjacent layer of tape, while too weak a signal will be lost in the background hiss.

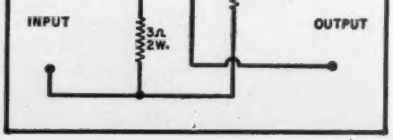
In communication radio transmitters, voice compression helps to override noise. In high-fidelity broadcasting and recording the trend today is away from volume compression, to insure full dynamic range.

The average listener, however, may not want his music too loud, to avoid offending the neighbors; nor can he have it too soft since ordinary room or street noises will drown out the music.

The volume expander, by the same token, is useful for restoring full dynamic range to an old record or to reception over a channel where compression has previously been employed.

A good volume expander-compressor is a useful addition to any audio system, provided it doesn't introduce unnecessary distortion and is easy to operate.

Schematic of volume expander-compressor.



The complete circuit of such a device is shown in the diagram. It uses only three components, and connects directly between the output transformer and the speaker voice-coil. It is designed for speaker impedances from one to eight ohms and for amplifiers in the 1-10 watt class.

The operation depends on the characteristics of the #47 pilot bulb. The resistance of the bulb increases as more power is applied to the circuit; however, the thermal heat capacity of the filament is sufficient so that its resistance remains constant over several cycles of audio. This latter characteristic preserves the waveform of the audio. Some may find that the attack and decay times are far too long due to the thermal lag of the bulb's filament, but the simple gadget is worth trying if this characteristic is not too objectionable.

There is only one control to the compressor-expander: the potentiometer. This should be mounted near the volume control for greater convenience, since a change in the setting of the expander will affect the volume as well as the degree of expansion.

In operation, the lamp will glow and also serve as a visual volume indicator. When testing the circuit for the first time, set the volume so that the bulb glows moderately brightly. Now by adjusting the potentiometer, you will find there will be a null point near the center of its range, where the sound will be weakest. This is the balance point of the resistance bridge, and the greatest degree of compression will be found just below this point, and the greatest degree of expansion just above this point.

For moderate compression, turn all the way down; for moderate expansion, turn all the way up.

For use as a squelch circuit, set the potentiometer to balance on noise; the signal will then unbalance the circuit and come through, when present, while in the absence of signal the noise is blocked-out. This is especially useful for playing old scratchy records since it not only squelches the scratch, but also expands the dynamic range of the record.

In home recording, the compressor setting can be used when recording and the expander used on playback.

For the radio amateur's transmitter, a maximum of speech compression is very effective in overriding QRM and QRN. However, if speaking from an acoustically noisy location, the expansion adjustment to balance out distracting local background noise may prove helpful at the transmitting end.

A few words about the losses of the expander. You will need to set the volume control higher than usual to overcome the losses in this circuit. And these losses are greater near balance where the most effective action takes place. If more power is needed, it should be added after the expander in the form of a power amplifier. —30—

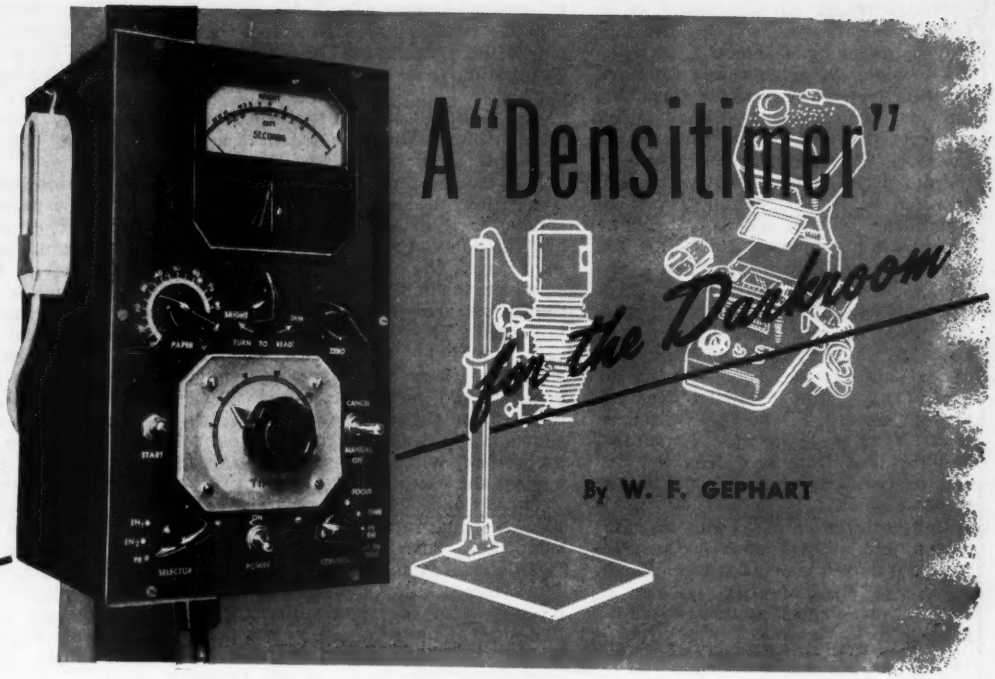


Fig. 1. Front view of the "Densitimer," as mounted on wall, showing the probe clipped to side. Dials and controls are lighted.

Details on a home-built exposure meter for an enlarger, an enlarger timer, and control-switching unit for photographic printers or enlargers, all housed in a compact enclosure.

MOST photographers have long recognized the value of an enlarger timer for the darkroom, and many have wanted an exposure meter for the enlarger as simple as the meter for the camera. Some, who have more than one enlarger, or other equipment to be controlled, have felt the need for a switching unit, to eliminate excess cords and switches and the need for changing plugs. The unit to be described covers all three of these needs, although any part of it can be built separately.

This unit consists of a photoelectric enlarger exposure meter, an electronic timer, and various control switches. Any one of three units (enlargers or printers) can be controlled by the unit which provides timed, manual, or external (footswitch) contional part required is R_4, a 1-megohm, required, which can be set on the timer, which can then be started by either a panel switch or external footswitch. A spring-return "Manual" (S_6) and a locking "Focus" position on "Control" switch S_4 are also provided.

Circuit Description

The exposure meter circuit consists of the photocell V_2, V_1, V_3, V_4, and their associated components. The two halves of V_3 are connected in a balanced bridge circuit whose indicating meter is set to zero (under no-signal conditions) by R_{10}. When light strikes the photocell, current flowing in grid resistance R_2 unbalances the bridge and is indicated on the meter. The operating point of the bias on the tube is such that the action will be linear and the meter deflection will be directly proportional to the amount of light striking the photocell.

To provide stable operation, the supply voltage for the photocell (150 v.) is regulated by V_1. The cell load, R_2, is variable, to allow for various speed photographic papers. The cell output, for a given amount of light, is reasonably constant with loads down to about 10,000 ohms, and R_2 should not be set below this value unless special calibrations are made.

The cell used is well-suited to this application, due to its small size and good sensitivity. The face is less than ¼" in diameter which permits the measurement of light through a very small negative area. Since consistent exposure results can best be obtained by measuring shadow areas where minimum detail is required, the small cell permits accurate measurements even in small diameter enlargements. Furthermore, the short length (about ½") permits the sensitive area to be very close to the focal plane on the enlarging easel. These cells may be secured from *Allied Radio Corporation* in Chicago, or from the *Clairex Corporation*, 50 West 26th Street, N. Y.

The over-all sensitivity required will depend largely on the illumination of the enlarger to be used. The ideal design must be linear over its range, and should permit a reading over a wide range of lens apertures and magnification diameters. Since there is no simple way to foresee the sensitivity requirements for any given enlarger, the circuit was designed to use any of several twin triodes, with different amplification factors, interchangeably. A 12AT7 furnishes maximum sensitivity, a 12AV7 medium, and a 12AU7 minimum sensitivity. The cathode resistance provides sufficient bias to stay within the operating range of all three tubes, so the proper tube can be selected after the unit is built, during testing and calibration.

Two ranges are provided to give a wide range of readable exposure time. Since the longer exposure times tend to crowd into the lower end of the meter scale, about a five-to-one time ratio is all that can be read on a single scale. The other range is established by switching a resistance across the meter, to reduce its sensitivity, and permit readings at bright light values. This switching is done by S_1, which also connects the cell into the circuit for reading. This is a spring-return switch, to keep the cell out of the circuit during high light intensities, such as when the room lights are on.

The timing circuit is essentially that shown in the article "Bootstrap Interval Timer" in the October, 1954, issue of RADIO & TELEVISION NEWS, except that a single range and timing capacitor are used. This particular circuit provides a range from less than one second to about 32 seconds. Increasing the size of either C_5 or R_{19} will increase this range if desired. Care should be taken in the selection of C_5. This should be a high-quality oil or paper capacitor, preferably of the sealed type. Electrolytics should be avoided because of instability.

The switching circuits consist of S_2 (which selects the unit to be controlled, as plugged into SO_1, SO_2, or SO_3), while S_1 selects the function. Position 1 is "Focus" which turns the unit on, position 2 is "Time" which connects the unit to the timer, position 3 is "Footswitch" which connects the unit to an external footswitch, and position 4 is "Footswitch Time" in which the unit is connected to the timer, but the timer is started by the footswitch, rather than the panel button.

If only one unit is to be controlled, the three sockets and S_2 (in dotted area "A," Fig. 4) may be eliminated, and a single socket connected to the arm of S_1. If the footswitch features are not desired, S_1 and SO_4 (in dotted area "B," Fig. 4) may be eliminated, and the lead from relay contact "X" run to the arm of S_2. If neither of these functions is needed, all parts within both dotted areas may be eliminated, and a single socket connected with the dotted leads shown to SO_1. In such case, the "Manual" position of the "Manual-Cancel" switch is used for focus.

Construction Hints

The unit shown in the photos was designed to hang on the darkroom wall hence a vertical arrangement was required. Construction would be simpler if all sockets were mounted on the front panel and a horizontal arrangement would eliminate the need for two chassis. If the unit is to hang on a wall, it is best to have the sockets on the bottom, and with a horizontal arrangement, a "Flexi-Mount" *ICA* chassis is recommended, since the panel and bottom can be one piece, eliminating the need for a connecting cable.

The photocell is mounted in a small wooden block, with the sensitive surface flush with the top (see Fig. 3). A hole is gouged out of the bottom for connecting the leads, which is two-conductor shielded microphone cable, and the hole is covered with an aluminum plate. The block should be painted white, to simplify locating the proper shadow area of the negative being projected. The sensitive area of the cell should be shielded from light whenever it is not being used, and plans should be made to provide a bracket on the side of the case, as shown in Fig. 1, to hold the cell mounting block with the sensitive area against the case.

The "Cancel-Manual" switch provides a spring return on the "Manual" side (for "flash" exposures) and a locking switch on the "Cancel" side. The latter position cancels any timing interval after the timing has started, if desired. However, the switch must be left in the "Cancel" position approximately the length of the timing interval, so the locking feature seemed desirable. Since such a switch was not available to the author when he built his unit, one side of a *Switchcraft* 3003L was altered by filing down one shoulder of the plastic actuator, to provide a spring return. The spring-return version of this switch (3003) is also not suitable.

Since the unit is to be used in a darkroom, certain items on the panel must be illuminated. The entire panel could be made of translucent plastic and illuminated from the rear, although most of it can be seen well enough by safelights. However, the meter and timer control should be illuminated.

Since illuminated meters are not too common, a regular meter can be converted. The meter assembly is removed from the case, and a ⅜" hole was drilled in the back of the case, large enough to admit a pilot light. A second hole was drilled and tapped to mount the pilot light holder, and a red bulb was used. The regular metal scale of the meter was replaced with one of translucent plastic, on which calibrations were made.

To illuminate the timer dial, a three-inch hole was cut in the steel panel, and a dial plate was made of translucent plastic. This plate was somewhat larger than the hole in the panel, and was fastened to the panel with screws. The timer potentiometer was mounted on the plastic and calibrations lettered on the plastic with India ink. Two red lights were mounted inside the cabinet, behind the translucent plastic.

To provide ventilation, holes were cut in the top and bottom of the case, and covered with screened ventilation plugs.

Calibration

Before starting any phase of the calibration, it is essential that all tests be made under operating conditions. The unit should be in the cabinet, with the back on, and a minimum of 10 minutes warm-up should be allowed before testing.

In making the timer dial, a 300-degree arc should be scribed on the plastic before the hole for the potentiometer is drilled, using the center-point of the control as the center of the arc. Also scribe a similar arc on a piece of bond paper. When mounting the potentiometer, fasten the paper to the front of the plastic with rubber cement. During calibration of the timer, marks can be made on the paper. When calibration is complete, an awl pressed against the marks on the paper will transfer the calibration points to the plastic. The paper can then be removed, and lettering done on the plastic.

In calibrating the timer, a stop-

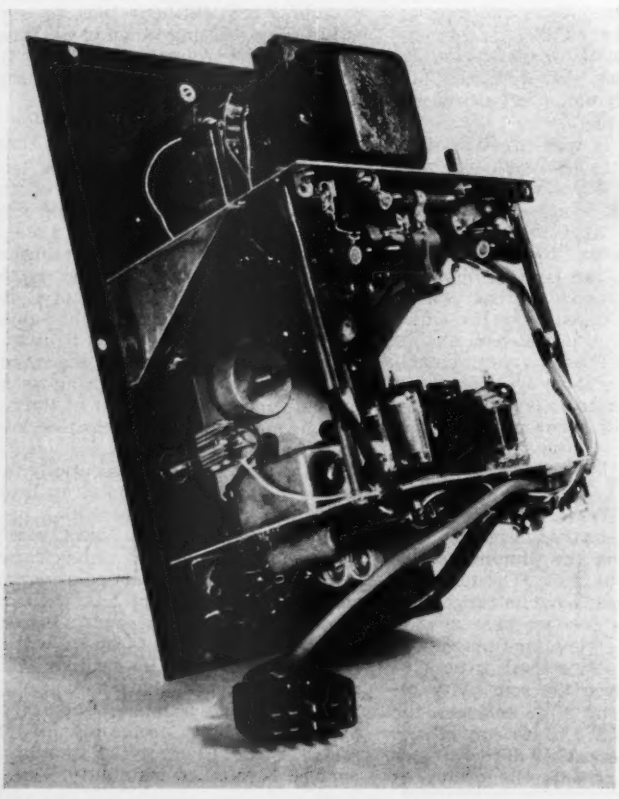
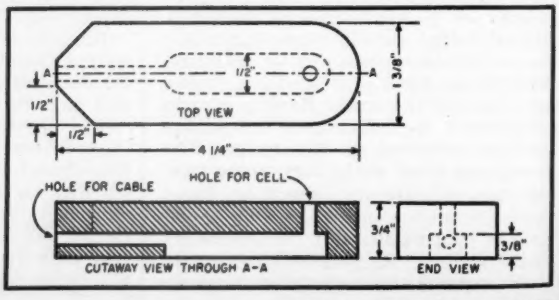
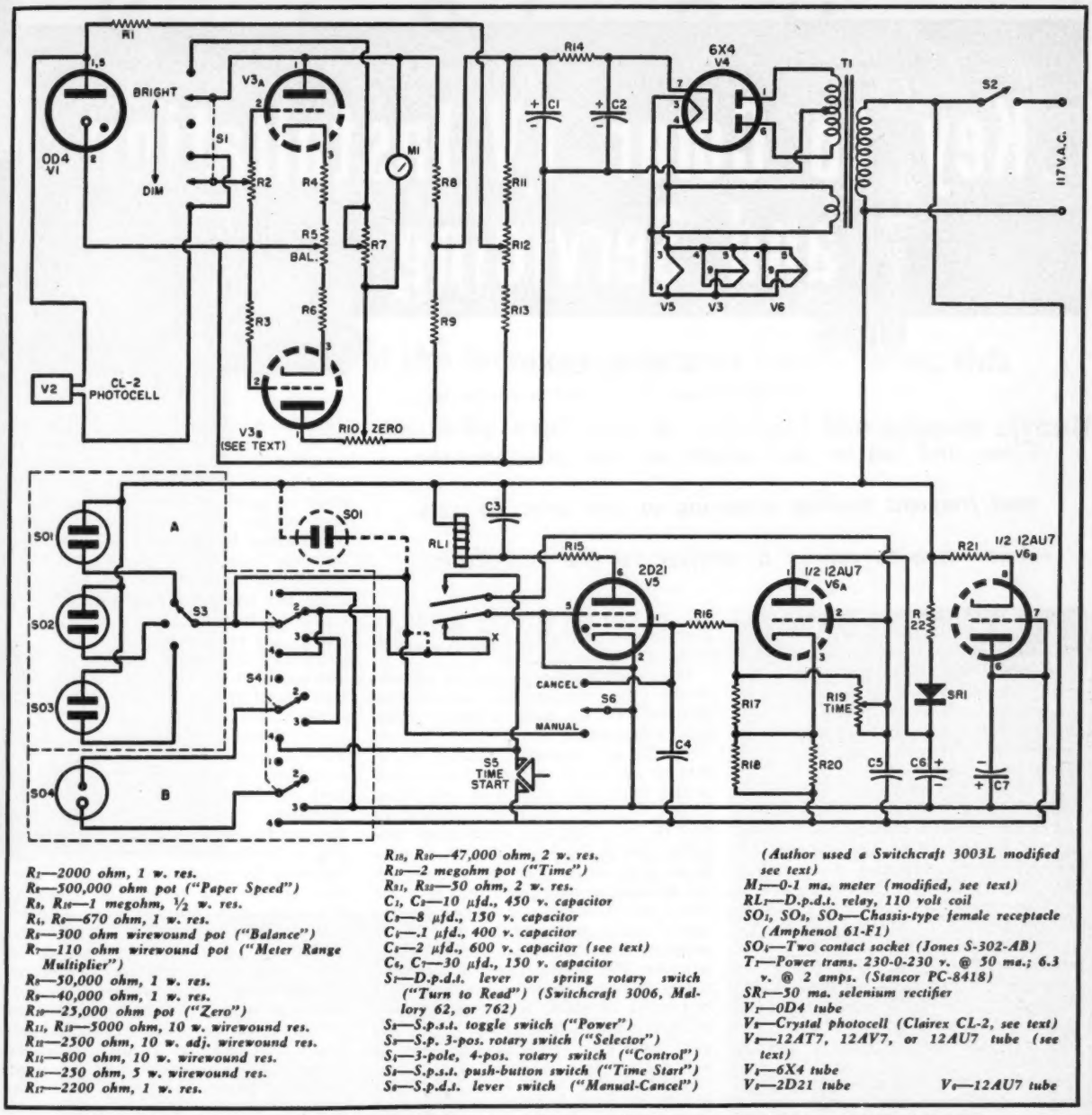


Fig. 2. Chassis view of the instrument. The top chassis houses the density measuring circuit, the bottom chassis is the timer unit.

Fig. 3. Mechanical details for building the photocell mounting block. It should be painted white to simplify the operation.





R1—2000 ohm, 1 w. res.
R2—500,000 ohm pot ("Paper Speed")
R3, R16—1 megohm, ½ w. res.
R4, R6—670 ohm, 1 w. res.
R5—300 ohm wirewound pot ("Balance")
R7—110 ohm wirewound pot ("Meter Range Multiplier")
R8—50,000 ohm, 1 w. res.
R9—40,000 ohm, 1 w. res.
R10—25,000 ohm pot ("Zero")
R11, R12—5000 ohm, 10 w. wirewound res.
R13—2500 ohm, 10 w. adj. wirewound res.
R14—800 ohm, 10 w. wirewound res.
R15—250 ohm, 5 w. wirewound res.
R17—2200 ohm, 1 w. res.
R18, R20—47,000 ohm, 2 w. res.
R19—2 megohm pot ("Time")
R21, R22—50 ohm, 2 w. res.
C1, C2—10 μfd., 450 v. capacitor
C3—8 μfd., 150 v. capacitor
C4—.1 μfd., 400 v. capacitor
C5—2 μfd., 600 v. capacitor (see text)
C6, C7—30 μfd., 150 v. capacitor
S1—D.p.d.t. lever or spring rotary switch ("Turn to Read") (Switchcraft 3006, Mallory 62, or 762)
S2—S.p.s.t. toggle switch ("Power")
S3—S.p. 3-pos. rotary switch ("Selector")
S4—3-pole, 4-pos. rotary switch ("Control")
S5—S.p.s.t. push-button switch ("Time Start")
S6—S.p.d.t. lever switch ("Manual-Cancel") (Author used a Switchcraft 3003L modified see text)
M1—0-1 ma. meter (modified, see text)
RL1—D.p.d.t. relay, 110 volt coil
SO1, SO2, SO3—Chassis-type female receptacle (Amphenol 61-F1)
SO4—Two contact socket (Jones S-302-AB)
T1—Power trans. 230-0-230 v. @ 50 ma.; 6.3 v. @ 2 amps. (Stancor PC-8418)
SR1—50 ma. selenium rectifier
V1—0D4 tube
V2—Crystal photocell (Clairex CL-2, see text)
V3—12AT7, 12AV7, or 12AU7 tube (see text)
V4—6X4 tube
V5—2D21 tube
V6—12AU7 tube

Fig. 4. Complete schematic of the "Densitimer" for darkroom applications. Standard parts are used throughout.

watch is handy, but any large sweep second hand on a clock can be used. Do not plug an electric clock into the timer for calibration; the time lag of starting, and "coasting action" when stopping will give inaccurate results.

Before calibrating the exposure meter, run some tests in your own darkroom, to determine the minimum and maximum "usual" exposure times. This will determine the "desired usable range" that you should work toward, such as 3 to 30 seconds, 5 to 40 seconds, etc.

To start calibration, set the enlarger up to provide the minimum exposure normally encountered, such as 2, 3, or 4 seconds. To do this will require an average negative and several test strips.

Using one of the three tubes (preferably a 12AV7 with medium sensitivity), and with the "Turn to Read" switch in the center (off) position, set the meter needle to any easily-read value (*e.g.*, 60), using the "Zero" control. Then, with the photocell unplugged, turn the "Turn to Read" switch to "Bright," and adjust R_7 to read one-third value. This establishes two ranges, one being three times the other.

Plug in the photocell and re-set the meter to zero with the "Zero" control. Place the cell face in the shadow area of the projected image set up above, and turn the "Turn to Read" switch to "Bright" (which has the resistance in the meter circuit). Then adjust the "Paper Speed" control to see if a full-scale reading can be obtained on the meter. If the paper used in the test strips was an average speed enlarging paper, it is preferable to secure full-scale deflection with the paper control near the center of the range. Naturally, this step must be done in the darkroom.

If, under the conditions just outlined, full-scale reading is determined with the "Paper Speed" control at about mid-range, your unit will properly measure minimum exposure. If full-scale deflection cannot be obtained, a more sensitive tube must be used, and if the "Paper Speed" adjustment is too critical, a less sensitive tube should be used. If a more sensitive tube still will not provide full-scale deflection, the ratio of the ranges can be reduced to two-to-one, by re-adjusting R_7.

(*Continued on page* 134)

Key to Color TV Installation and Servicing

By **W. W. COOK**
Technical Training Section, RCA Service Co., Inc.

Clear and concise instructions on how to repair the most frequent troubles occurring in new color TV sets. Also—how to set up a receiver for the installation.

BASICALLY, the installation procedure for the latest line of color television receivers is much less involved than for the earlier models. In most cases, the only installation requirement is de-magnetization of the picture tube. This should be done irrespective of whether or not it is considered necessary.

To accomplish de-magnetizing, use a coil 12 inches in diameter and consisting of 400 turns of #20 enameled wire. To this coil attach an a.c. line cord 10 feet in length with a switch. Apply 117 volts a.c. to the coil, holding the coil with its plane parallel to the face of the picture tube. Move the coil slowly about the face of the CRT for a few moments, then back away from the tube about 6 feet and turn the coil 90° so that it is perpendicular to the face of the tube. Remove the a.c. from the coil and the de-magnetizing job is completed.

Shown in Fig. 2 is a color-contaminated black-and-white picture on a color picture tube. This condition may be caused by a magnetized picture tube and the simple de-magnetizing procedure given here could save many fruitless hours of attempting to correct this situation by other means.

In some cases the condition shown in Fig. 2 could be caused by the yoke or purity magnet becoming dislodged during receiver shipment. If de-magnetizing does not cure the condition, turn the blue and green screen controls completely counterclockwise. A red picture with color impurity at the edges of the screen will result. Adjust the yoke and/or the purity magnet until a uniformly red picture is obtained. Then readjust the blue and green controls to obtain a good black-and-white picture. It is very important that center convergence be maintained during the purity adjustment. Otherwise, a good red field may be obtained but the blue and green fields may be slightly contaminated causing a poor black-and-white picture.

After completing the purity adjustments, the convergence should be checked. To do this, a convergence generator causing a crosshatch pattern (Fig. 1) or regularly spaced white dots to appear over the entire screen of the color tube should be connected to the receiver. Many dot generators provide both dot and crosshatch patterns. One method of using these patterns is to work with the crosshatch for dynamic convergence and dots for final static adjustments. Generally, dynamic convergence adjustment is not required for the initial setup of the receiver. Fig. 5 illustrates a condition where red and green has shifted. This is typical of static convergence complaints. A slight adjustment of the red and green d.c. convergence controls will correct this condition.

Obtaining a good black-and-white picture is extremely important if good color reception is to be expected. Some of the newer black-and-white picture tubes tend to give a slightly bluish tint to white areas whereas the early 10-inch picture tubes were on the brownish side. The black-and-white picture on a color tube should be adjusted so as to be slightly brownish in color. Most technicians lean too heavily in the blue direction. In many cases the picture is much too blue, even bluer than the bluest black-and-white picture tube. As a guide, check the picture against the one on a black-and-white receiver if one is available. If not, lean slightly toward the brownish hue. Doing this will actually enhance color reception since, if the tube has a bluish background, flesh tones will wash out or become very pasty looking.

After checking out the color receiver for black-and-white reception, check it for color. If color program material is not available when the receiver is installed or being serviced, a color-bar or similar color pattern generator must be used. A normal bar pattern presentation with receiver correctly adjusted is shown in Fig. 1. Note that the bars range from red on the left through blue to green on the right. Each bar has some significance when adjusting the color receiver. For example, the third bar from the left is vectorially 90° from burst phase and represents *R-Y*. The sixth bar is 180° from burst and represents *B-Y*.

When the color-bar pattern is adjusted properly, the fourth bar should have a magenta color. In Fig. 6 the second bar is magenta. This indicates that the hue control is adjusted improperly. It should be rotated until the fourth bar is magenta as seen in Fig. 1. If the fourth bar can be made magenta by rotation of the hue control, but if as a result, the colors of the other bars are incorrect, a complete matrix adjustment must be made.

Basically, there are two methods by which this adjustment can be accomplished using the color-bar generator. An oscilloscope can be connected to the grids of the picture tube and adjustments made to obtain the proper waveforms. This method is the most accurate; however, it may be inconvenient to carry an oscilloscope into the customer's home. An alternate method of matrix adjustment which is simple and accurate will be described here. It is necessary in this method to make two of the guns in the kinescope inoperative while the third is being used. To accomplish this conveniently, connect a 100,000-ohm resistor between the grid of each gun to be cut off and ground. Take two clip leads, cut them in half, and insert a 100,000-ohm resistor in series with the two parts of each lead. Thus, one end of the lead can be connected to the grid and the other end to ground.

If the blue and green guns of a color tube were cut off by means of these clip leads, and if a color-bar generator were connected to the receiver, the resulting red pattern would be that due to the *R-Y* signal. The sixth bar from the left, which was formerly blue,

(*Continued on page* 55)

Key to Color Patterns

The color patterns shown here will help you install and service color TV. If the receiver displays any of the incorrect pictures reproduced, this tells you why, and how to correct the proper circuit.

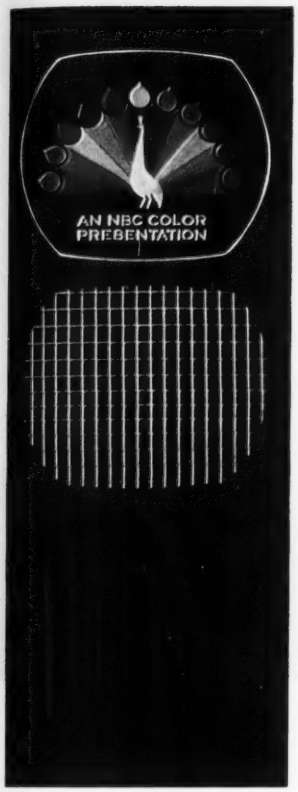


Fig. 1. The pictures shown here were displayed on the face of a normally-operating color TV set. At the top is the peacock color trademark of NBC. The crosshatch pattern (center) indicates good convergence; the color bar pattern shows correct hues.

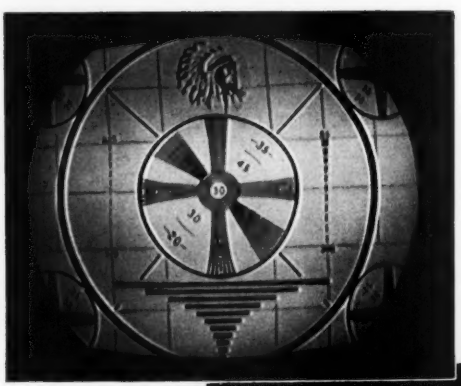


Fig. 2. This black-and-white picture displayed on a color set shows color contamination due to a magnetized CRT or dislocated purity magnet and/or deflection yoke.

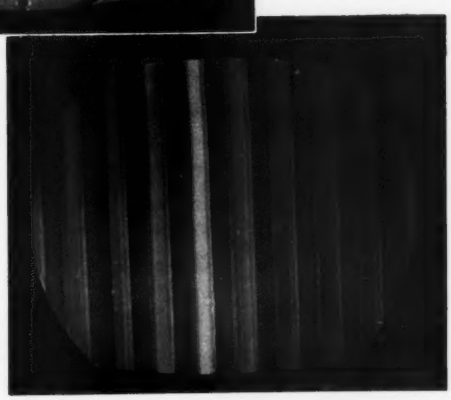


Fig. 3. The edges of the color bars shown here are not sharp and distinct as they should be. This indicates "ringing" and is usually due to a defect in the video stage (check for an ungrounded delay line).

Fig. 4. Right. This pattern shows loss of color sync (the input is from a color bar generator). Check the 3.58 mc. oscillator and synchronization circuit.

Fig. 5. Right center. Red and green lines appear in this crosshatch pattern indicating lack of static convergence. To correct this adjust red and green d.c. convergence controls.

Fig. 6. Bottom right. In this pattern, the second bar from the left is magenta—it should be red. If adjusting the hue control does not correct the pattern, the color phase controls must be readjusted.

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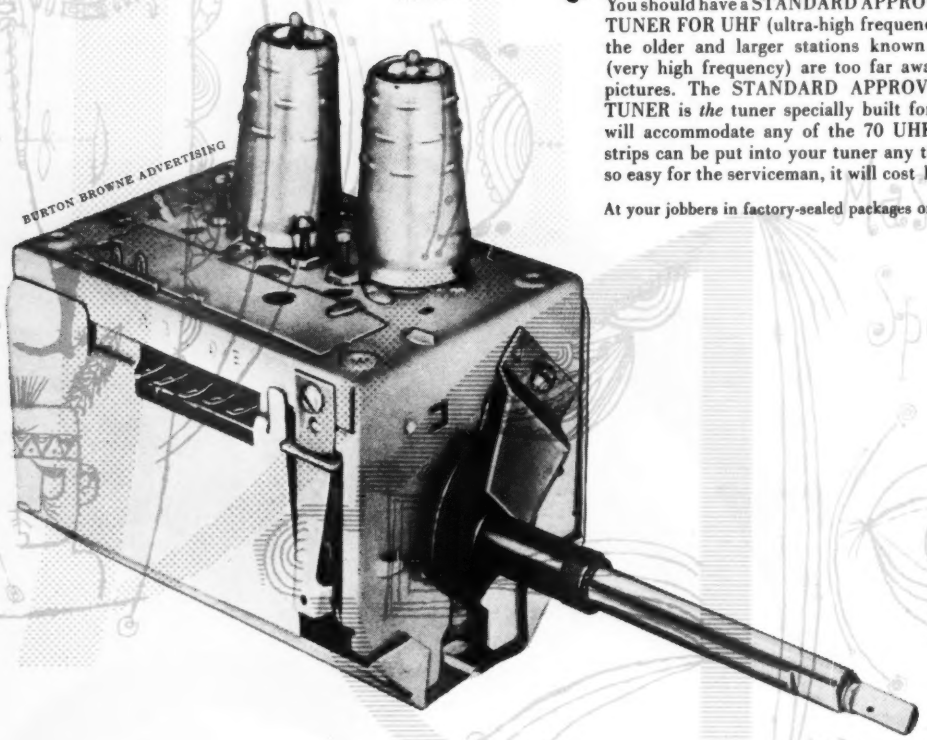

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should be the same brightness as the adjacent red background. This bar represents *B-Y* and the fact that its brightness is the same as that of the background indicates that the magnitude of the *B-Y* signal on the red grid is zero, which is correct. If the sixth bar is not the same brightness as the background, then the phase of the *R-Y* 3.58 mc. c.w. signal needs to be readjusted. All recent color receivers have a control for this; on the *RCA* color sets using the CTC5 series chassis, for example, the top slug of transformer T_{705} is the applicable adjustment (see Fig. 7).

After making the necessary adjustments to obtain the correct pattern, remove the clip lead from the blue grid and attach it to the red grid. Now the green and red guns are cut off leaving a blue color bar pattern. In this pattern, the third bar from the left is of the same color content and brightness as the adjacent background, which is blue. This bar represents *R-Y* and its appearance shows whether there is any *R-Y* signal on the blue grid. If there is some *R-Y* signal on the blue grid, bar three will not show up as pure blue and the phase of the *B-Y* signal has to be reset. This is effected by varying the *B-Y* 3.58 mc. c.w. phase control.

Next, remove the clip lead from the green grid and connect it to the blue grid. A green bar pattern should be on the screen now. Here the seventh bar should be the same brightness as the adjacent background. If not, adjust the *G-Y* phase control.

With all of the conditions met as a result of adjustments, the bar pattern shown in Fig. 1 should be obtained after removing the clip leads. Checking the receiver in this manner will assure the customer proper color operation.

The antenna system is the only other link to be checked out during installation. Most TV stations currently transmitting color provide a color test stripe during black-and-white transmissions. This vertical stripe is positioned at the right hand side of the screen and is normally not visible. However, by setting the fine tuning control so that sound bars are barely visible and adjusting the horizontal frequency so that the picture moves to the left, the stripe will become visible, provided the color control is turned maximum clockwise. With the hue control set properly, the color of the stripe should be a greenish yellow.

If the stripe cannot be obtained and it is known that it is being transmitted, re-orienting the antenna is usually all that is required. In addition to this, it is a good idea to check the transmission line for opens and poor termination. Also check the lightning arrester if one is present.

Customer Instruction

After completing the color receiver installation it is very important that the customer be properly instructed on the use of the customer controls. Probably the best starting point is to obtain a good black-and-white picture. First, set the fine tuning control to the point where sound bars appear in the picture, then turn back the control until the bars just disappear. This must be done with the color control fully counterclockwise or in the off position. Adjust the contrast, brightness, and fine tuning controls for proper color saturation. The hue control can then be adjusted for proper flesh tones.

If there is no color transmission at the time of customer instruction, make sure he or she can demonstrate proper black-and-white picture adjustments. However, explain the proper use of the hue and color controls. Service calls can be greatly minimized by a good receiver installation and proper customer instruction.

Service calls after initial installation include the normal troubles encountered in black-and-white sets plus additional problems related only to color. The troubles dealing with color only include: no color, improper color, no color synchronization, and low color saturation.

Before attempting to service the color circuits, it is important that the receiver must be capable of receiving a normal black-and-white picture. The same techniques apply for servicing the black-and-white circuits of color receivers as those presently employed in the service of standard monochrome receivers. The only exception to this is the picture tube circuitry.

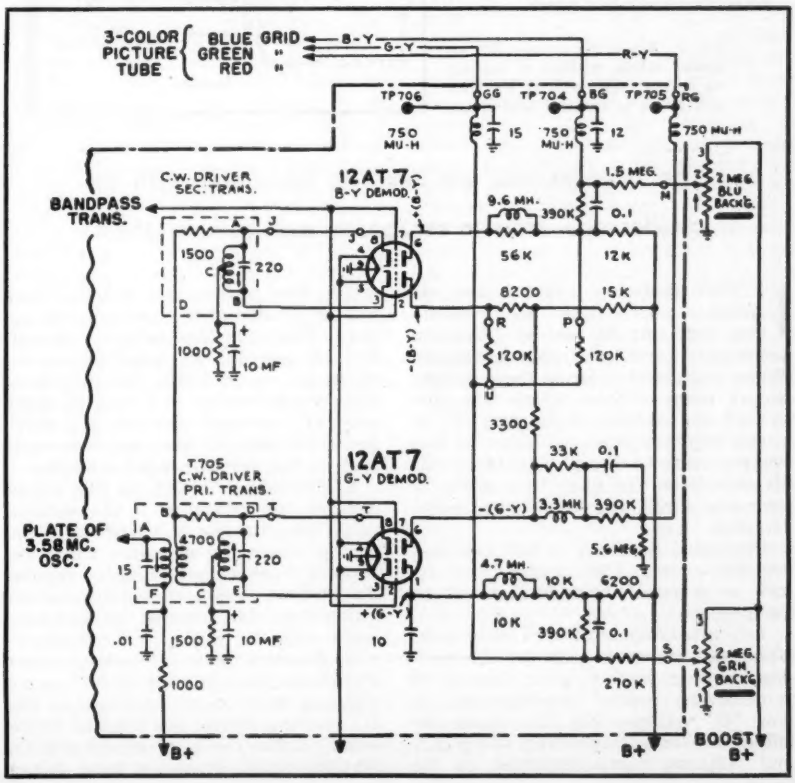
It is possible that the customer may complain of a completely red screen during reception of a black-and-white TV broadcast. This would indicate that the red gun of the tri-color picture tube is shorted. However, the bias voltages should be checked before replacing the picture tube. Also, the customer may complain of color fringing around objects in an otherwise black-and-white picture. This would indicate that either convergence is misadjusted or that there is trouble in the convergence circuits. Another possible customer complaint may be that there is color contamination in the black-and-white picture (Fig. 2). If the set was properly installed and adjusted initially, this trouble would indicate that the receiver has been moved. De-magnetizing will probably clear this up. These malfunctions have no real bearing on the color circuits yet appear as colored defects.

To service the color circuits, it is usually necessary to use a color-bar generator or other source of color signal for troubleshooting. This is necessary since there may be no color telecast at the time of the service call. Also, by using such equipment, the technician can check the color matrixing as a final step of the service call.

Troubles in the color section are usually confined to the bandpass am-

(*Continued on page* 179)

Fig. 7. Schematic diagram of color demodulator circuits of the RCA CTC5 chassis. When it is necessary to correct color phasing this is done by adjusting the top and bottom slugs of transformer T_{705}. The various color tube grids are connected to ground via test points TP_{706}, TP_{705}, and TP_{708}, through 100,000 ohm resistors.



Service Your Own Oscilloscope

• • •

By
W. L. WEEKS
Philco Calibration Dept.
Croydon Plant

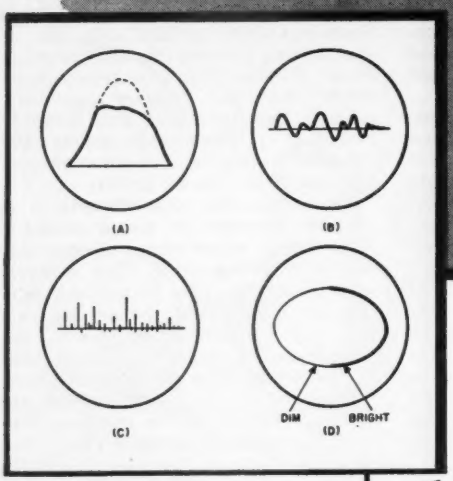


Fig. 1. How overloading, microphonics, random pulses, and poor intensity show up on the oscilloscope tube's screen.

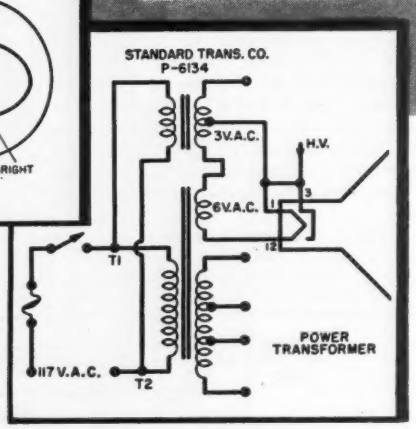


Fig. 2. When the scope CRT becomes weak, adding a booster, as in the case with a TV CRT, will serve to prolong usefulness.

The troubles you are likely to encounter with an oscilloscope. How to recognize and remove them.

IN THE past few years, many oscilloscope kits have been assembled and put to use by television technicians and electronic hobbyists. When troubles develop in these oscilloscopes, many of those people who purchased and assembled the kits are at a disadvantage when it comes to correcting such troubles. The scope has its own brand of bugs that are only remotely similar to television or radio troubles.

Presented here are a few common troubles along with suggestions on how to proceed in troubleshooting an oscilloscope:

1. Overloading and low vertical gain: The most common cause of overloading or poor vertical gain, outside of a defective vertical amplifier tube, is low "B" voltage. Fig. 1A shows the effect of overloading with a sweep output response curve displayed on the scope. The broken line indicates how the top portion of the curve should appear. The solid line indicates the effect of overload as amplitude is increased. It is advisable, before tearing the vertical section to pieces, to check your "B" voltage. A weak 5Y3 rectifier in the back of the scope can really foul up the vertical input amplifier.

2. Microphonic effect: In Fig. 1B we can see the effects of a microphonic tube. The trouble is particularly annoying when the operator wishes to observe weak signals. Lightly tapping the vertical amplifiers will disclose the faulty tube, but usually the high-gain input amplifier is the chief offender.

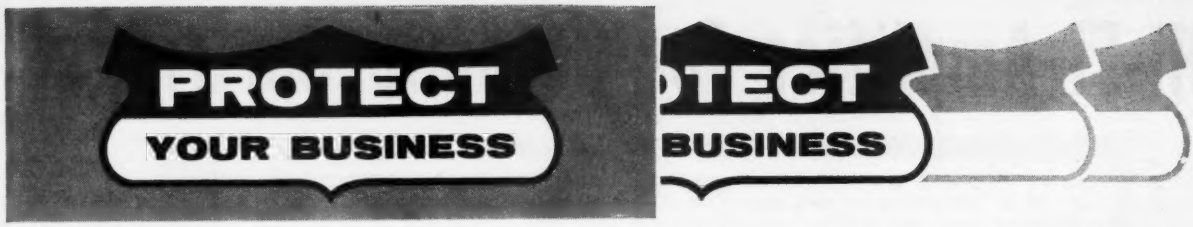
3. Random pulses: Random pulses, affectionately called "figliggies" by our group at work, occur as shown in Fig. 1C, running across the baseline of the scope. Again the chief offender is the vertical input amplifier tube, which has usually developed high tube noise. Many scopes now use a voltage regulator tube, 0D3 or similar type. When these become defective, they can produce a similar effect.

4. Poor focus: The high voltage rectifier supplies the accelerating and focusing potentials and is the chief cause of poor focus and intensity. Since the deflection plates affect the beam after it is sharply focused, noisy centering controls occasionally cause a slight defocusing of the beam. If noisy carbon potentiometers are causing the defocus, this can be detected by observing the sharpness of focus as the control is rotated. A slight rotation will seem to shift the phase of focus from vertical to horizontal. Power supply hum due to defective capacitors will affect focusing the same way, but in a more exaggerated manner.

5. Poor intensity: After a few years of use, you could expect a cathode-ray tube to weaken but usually you will go through several high voltage rectifiers before replacing a CRT. Fig. 1D shows an unusual intensity problem caused by the high-voltage capacitor losing capacity due to drying up or old age. Replacing the high-voltage capacitor will eliminate this problem. The hum developed by the defective capacitor causes a blanking effect on the beam. If the CRT does become weak, it is possible to add a booster as shown in Fig. 2. This will give added life to your present oscilloscope. The transformer mentioned has adequate high-voltage insulation. On some scopes this booster transformer can be conveniently mounted on the CRT mounting bracket. Proper phasing must be observed in adding the 3 volts a.c. If you try this circuit and your weak cathode-ray tube does not light up, reverse connections T_1 and T_2 to obtain proper phasing.

6. Blowing fuses: If your oscilloscope continues to blow fuses after changing tubes, and checking with an ohmmeter fails to locate the short, the trouble is usually a faulty high-voltage capacitor. When you check the high-voltage capacitor with an ohmmeter, it may appear normal and charge up; but under the strain of a kilovolt it will break down. To check for this trouble, disconnect the high-voltage capacitor (observing safety precautions at all times) and energize the equipment. If the fuse does not blow, the capacitor is the culprit. If the fuse does blow, start checking with your ohmmeter again. Occasionally, the power transformer will short out, and since it has such low resistance, the ohmmeter is not much help. The most reliable piece of test equipment for a shorted transformer is the "nose" common to all troubleshooters.

Sweep generator circuits are not discussed because every manufacturer seems to use a special design. Some like neon tubes, thyratron circuits, or modified multivibrator types. The individual oscilloscope design would determine troubleshooting procedures on this part of the circuit. —30—



Developing Your Service Association

By **WILLIAM LEONARD**

The only successful defense against manufacturer service is possible through organized activity.

NEWS about the mass meetings of service operators that are being held in all parts of the country in protest against the extension of consumer service activities by the *General Electric Company* has overshadowed a very important development that was inspired by the steady efforts of manufacturers to expand their consumer service business.

The Television Service Association of Michigan, which long has been one of the industry's most dynamic and successful service organizations, has adopted drastic measures to show its displeasure to offending manufacturers for their stepped-up activities in the retail service market. Members of TSA realized, however, that while drastic measures might bring about some temporary restrictions in manufacturers' service promotions, the future of independent service could not be made stable and secure unless independent service shops themselves worked together in long-range programs for the improvement of their activity and for the protection of the set-owning public.

After two years of painstaking work, earlier this year TSA had succeeded in getting a television service licensing ordinance passed by the Detroit city council. This licensing law, which encompasses both shop owners and technicians, has been recognized as a superior measure.

TSA pushed for passage of the law only after it had exhausted all legal means to curb the activities of service sharpies in the Detroit area. In the most ambitious of its attempts to stop the gyps, the association contributed $500 to the Detroit Better Business Bureau for a campaign, and members gave freely of their time to assist the BBB and the district attorney pull the service malefactors into court. While they secured many convictions, there were no laws that prevented a culprit from opening a new service business under another name, immediately after a conviction, to continue his larcenous activities.

Most service associations are made up of only a small minority of the clean-minded, technically competent service dealers in their areas. As a result many of the best association programs fail to accomplish their objectives because of the lack of industry-wide support. Recognizing this weakness in the armor of the independent electronic service industry, the officials of TSA financed the development of a professionally prepared, comprehensive program to interest service dealers in cooperation —through associations—for their mutual well-being.

The complete association promotion campaign plan is assembled in a striking 9½" by 15", four-section folder. Assembled in this folder are all of the materials needed to put on an aggressive association "member selling" drive. The key piece is a 4-page folder titled "Unite to Fight," which details why independent service businessmen must work together to preserve a free market for the operation of service businesses in the electronics field.

A second section of the folder contains samples of stickers for use on letters and envelopes; postal meter messages; slugs for newspaper ads; and an independent dealer association decal.

The third section contains proofs of ads for dealer associations to run in local newspapers; mats for jobber house ads; and a cartoon book to mail to customers.

The fourth section contains a copy of the Detroit licensing bill with two separate flyers. One of the flyers carries a detailed explanation of the requirements for obtaining a Certified Technician's License, and the other covers those for a Television Service Dealer's License. The flyer to be used in urging service dealers to join their local association states:

"Do you want your business to develop into a real, solid security for yourself and your family? Most everybody else does, too!

"Throughout the country, other alert dealers are achieving this objective by joining their local independent organization: For, as the saying goes, in union there is strength. By banding together, business improvements, better public understanding, and a host of other benefits have been obtained. Things like ordinances to license only qualified service dealers are now in effect in many communities. A spirit of cooperation and free exchange of ideas, and a common code of practice and standardization of charges—formerly so confusing to the public—are notable accomplishments.

"As a member of an organization, your voice is heard. And, as a member of an organization, you are protected against any serious outside encroachment—swiftly and effectively. For the better business life and security we all must have, *Join Your Local Independent Service Association.*"

The copy for local newspaper advertising to set owners urges readers to patronize a local independent service dealer who displays the association emblem when a radio or TV set needs repairs. It tells the reader:

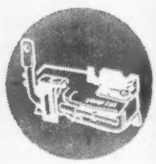
"Your local independent service dealer is the man to see when your radio or TV set needs attention. Your neighborhood dealer is a highly qualified local business man. He has invested a lot of time and money in technical training and in costly shop equipment to serve the entertainment needs of your community.

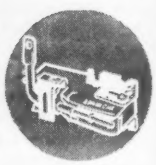
"As a resident of your town, your

(*Continued on page* 131)

Hi-Fi Amplifier for Ceramic Cartridges

Over-all view of the Sonotone HFA-100 amplifier which has been especially designed to be used with the firm's new "self-equalizing" cartridges.





By **ROBERT M. MITCHELL**
Sonotone Corporation

The use of high output ceramic cartridges permits the simplification of amplifier design and construction.

DURING the past ten years the high-fidelity world has seen many new developments. Some of these have been merely elaborations of existing ideas while others have been founded on truly new principles. In the entire picture there may be discerned a new trend which, although slow, is nevertheless firmly directed toward the simplification of high-fidelity equipment.

One of the outstanding developments in recent years has been the creation of the ceramic phonograph cartridge. The discovery that ceramic material could be made piezoelectric was independently made in the *Sonotone* laboratories in 1946. At that early stage the promise of the ceramic cartridge seemed to lie mainly in the fact that it was impervious to moisture and temperature variations. It was quite an event to produce a cartridge which behaved almost exactly like a crystal cartridge but which, at the same time, would last indefinitely in tropical climates, in the hot confines of a radio phonograph, or on the dealer's shelf. The first ceramic cartridges to reach the phonograph market in 1947 performed in an outstanding manner, which although not truly high fidelity by today's standards were nevertheless equal to the performance then obtainable from any piezoelectric device.

With the introduction of long-playing records the design of the ceramic cartridge was carried forward to the point where advantage could be taken of a second unique feature. This feature was the fact that the ceramic cartridge is a "constant-amplitude" type of transducer. That is, the voltage output of the cartridge is constant with frequency if the amplitude of the modulation of the groove is constant with frequency. This is in direct contrast to the "velocity" type of transducer (magnetic, reluctance, moving coil, etc.) in which the voltage output is proportional to the side-to-side speed of the needle in the groove. Since the present-day recording characteristic is very close to one having amplitude constant with frequency, it follows that a constant-amplitude pickup will play such records back almost flat without any need for equalizers in the circuit. Further careful attention to the design of the cartridge itself makes it possible to tailor the response to within a few db of the required characteristic. Thus the new *Sonotone* Series 3 cartridges play back the RIAA, LP, "New Orthophonic," etc. characteristics within 3 db of flat without any equalization, providing a proper load resistor is used.

When it is considered that the frequency response of the ceramic cartridge without equalization can equal that of most velocity cartridges employing commercially available equalizer amplifiers, it is apparent that the ceramic cartridge signals a new approach to true high fidelity. When on top of this is added the fact that the ceramic cartridge requires no preamplifier (its voltage is about 20 to 100 times that of most velocity types), that it is immune to magnetic hum pickup, that it has a compliance equal to or better than most velocity cartridges, that its distortion is equal to or less than that of many other types of cartridges one asks why it should be necessary to use equalizers, preamplifiers, oscillators, etc. to obtain high-fidelity phonograph reproduction.

(EDITOR'S NOTE: Ceramic cartridges are known to have more needle talk than the velocity type cartridge. However, *Sonotone* claims that its new Series 3 unit does not have this objection. It is also known that ceramic cartridges, in general, have a different tonal response (coloration) in comparison to other types of units. This may or may not be objectionable. Some individuals prefer this type of response while others object to it.)

The answer is, in the author's opinion, that such equipment is entirely unnecessary for the very best in high-fidelity reproduction. In fact such equipment may (and very often does) introduce noise, hum, and distortion. The fewer the links in the chain, the simpler, cleaner, and more reliable does the whole circuit become.

This is the philosophy behind the creation of the *Sonotone* HFA-100 amplifier. This unit was designed to work specifically with the new Series 3 ceramic cartridges.

The schematic of the amplifier is shown in Fig. 1. As may be noted, this is a very simple, straightforward circuit. Every individual part and value was carefully chosen to produce the optimum in performance. Several de-

partures from conventional practice were made in the design of the amplifier and since these are not all apparent from the schematic they will be discussed individually.

The load impedance presented to the output tubes has been changed from 8000 ohms plate-to-plate to 6000 ohms. This enables 12 watts to be obtained at the secondary of the transformer at 1% distortion without feedback. When feedback is applied the distortion is reduced to 0.1% or less.

Every tube, without exception, is enclosed in a feedback loop of at least 20 db. This means that the 0.1% distortion figure holds from the input to the output. This avoids the ridiculous situation, all too often encountered, of having a low-distortion power amplifier section preceded by a high-distortion voltage amplifier section.

The frequency response is flat at any setting of the volume control. This is achieved by making the volume control a low impedance (50,000 ohm) control, which is unaffected by stray capacitance following it. The importance of this cannot be stressed too much since it means that the high-frequency transient response is maintained no matter what listening level the user may choose.

The hum output of the amplifier is independent of any of the controls. That is, the hum is just as low with the volume and bass controls turned all the way up as it is with these controls in their normal position. This is achieved by using a d.c. filament supply for the first two tube sections. This is an added feature thought highly desirable, since, together with a ceramic cartridge, it permits full bass boost with negligible hum.

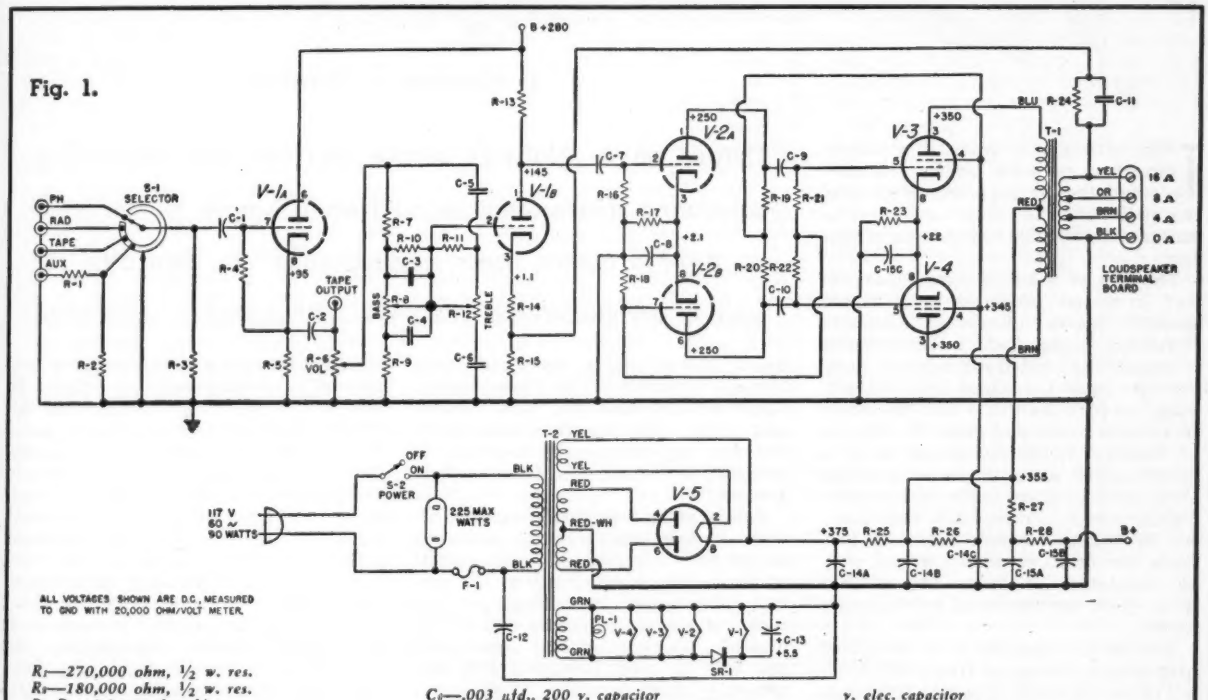
The frequency response is not flat *beyond* the audible range. The response is flat to 20,000 cps but beyond that it is deliberately controlled so as to maintain the transient response under working conditions. Many amplifiers have been shown to have a good transient response when working into a resistive load. The pattern at 10,000 cps is generally as shown in Fig. 2A. When many such amplifiers are connected to a loudspeaker, however, the response is more like Fig. 2B. The transient response of the HFA-100 amplifier is equally good on loudspeaker or resistive loads. The performance of a typical amplifier at 10,000 cps with a loudspeaker load is shown in Fig. 3.

The over-all circuit description is as follows: There are four inputs, all of which feed into the selector switch. Three inputs have an input impedance of 3.3 megohms and a sensitivity of 0.35 volt while the fourth has an input impedance of 0.5 megohm and a sensitivity of one volt. This fourth input is designed to accommodate a high output device, such as an extra-sensitive tuner.

The input tube is a cathode follower for several reasons: it presents a high input impedance to the ceramic cartridge, it has a low output impedance to feed the tape output jack and the

(*Continued on page* 159)

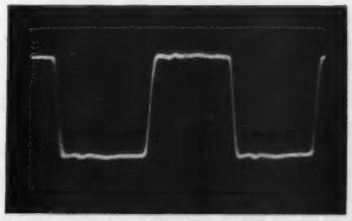
Fig. 1.



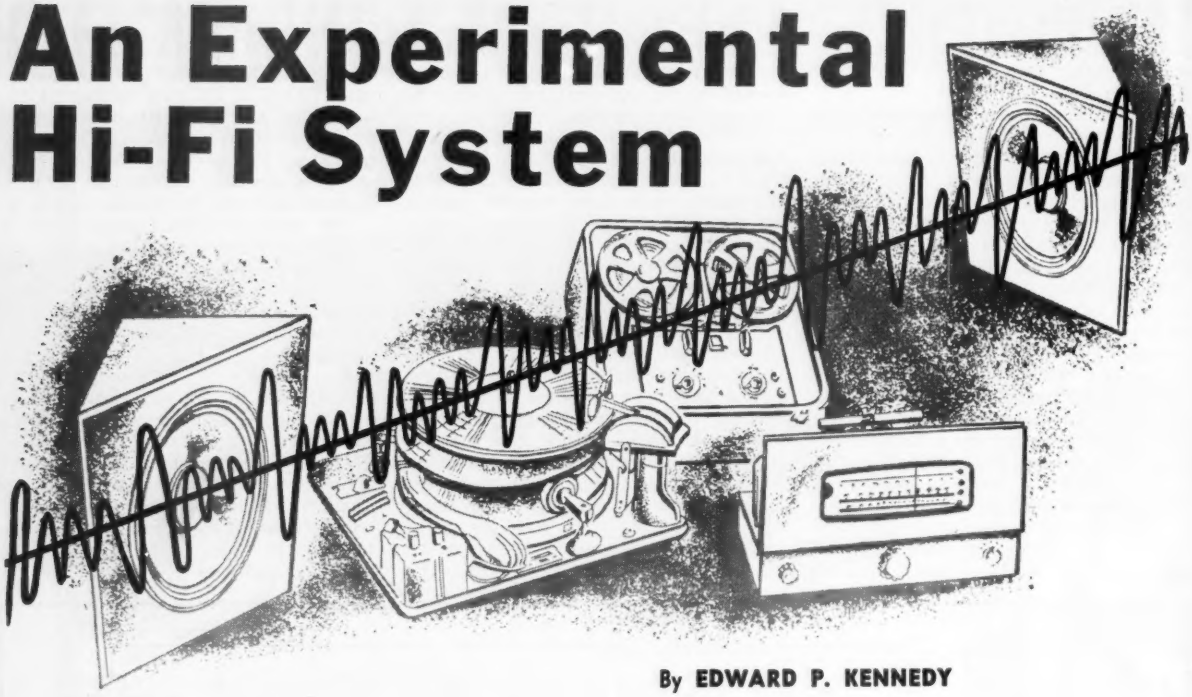
R_1—270,000 ohm, ½ w. res.
R_2—180,000 ohm, ½ w. res.
R_3, R_4—3.3 megohm, ½ w. res.
R_5—47,000 ohm, 1 w. res.
R_6—50,000 ohm, log taper, pot
R_7—100,000 ohm, ½ w. res.
R_8, R_{12}—1 megohm, log taper, pot
R_9—22,000 ohm, ½ w. res.
R_{10}, R_{11}, R_{16}—1 megohm, ½ w. res.
R_{13}—220,000 ohm, 1 w. res.
R_{14}—1500 ohm, 1 w. res.
R_{15}—47 ohm, 1 w. res.
R_{17}—820 ohm, ½ w. res.
R_{18}—100,000 ohm, ½ w. res.
R_{19}, R_{20}—100,000 ohm, 1 w. res.
R_{21}, R_{22}—330,000 ohm, ½ w. res.
R_{23}, R_{25}—250 ohm, 5 w. wirewound res.
R_{24}, R_{27}, R_{28}—15,000 ohm, 1 w. res.
R_{26}—1500 ohm, 2 w. res.
All fixed resistors should be of the ±10% composition type unless otherwise noted.
C_1, C_7—.22 μfd., 450 v. capacitor
C_2—.5 μfd., 200 v. capacitor
C_3—1800 μμfd., 400 v. capacitor
C_4—.008 μfd., 200 v. capacitor
C_5—750 μμfd., 400 v. capacitor
C_6—.003 μfd., 200 v. capacitor
C_8—50 μfd., 6 v. elec. capacitor
C_9, C_{10}—.1 μfd., 400 v. capacitor
C_{11}—200 μμfd., 400 v. capacitor
C_{12}—.05 μfd., 400 v. capacitor
C_{13}—2000 μfd., 6 v. elec. capacitor
C_{14A}, C_{14B}, C_{14C}—20/30/40 μfd., 450 v. elec. capacitor
C_{15A}, C_{15B}, C_{15C}—30/30/40 μfd., 450/450/50 v. elec. capacitor
PL1—No. 47 pilot light
SR_1—Selenium rectifier, 350 ma. @ 25 v.
F_1—2 amp., 250 v. fuse
T_1—Output trans. (see text)
T_2—Power trans. (see text)
V_1, V_2—12AX7 tube
V_3, V_4—6V6GT tube (see text)
V_5—5Y3GT tube (see text)

Fig. 2.

Fig. 3.



An Experimental Hi-Fi System



By **EDWARD P. KENNEDY**

Details on a relatively simple and low cost method of simulating dimensional sound from a single source, such as AM-FM tuners, tapes, phonographs, etc. Basically, the unit is an elaborated crossover with speaker separation.

THIS article will describe a simple crossover network which produces a simulated stereophonic effect that the audiophile may wish to try out in conjunction with his home music system.

The lack of so-called dimensional effect in sound produced by a single speaker leaves discerning listeners somewhat unsatisfied. In an attempt to supply the needed ascendency many listeners raise the sound level to deafening proportions. This fills the whole room with sound and gives the illusion of reality. When the sound level is raised above a comfortable listening level, unnatural and unpleasant physiological strain is imposed on the listener. By adding a simple crossover network the sense of sound spread may be simulated, providing the listener with good reproduction at moderate levels.

The several methods to be described here involve the use of frequency dividing networks which separate and channel certain bands of the reproduced audio frequencies into two or more loudspeakers. Adjacent corners of the room appear to be the most suitable location for the speakers. The sound sources to be considered here include radio programs, TV sound, tape recordings, phonographs, opera broadcasts, and the like. The illusion created by this method is most effective with music, especially orchestral selections or numbers recorded by groups which, when performing, occupy an area of appreciable dimensions.

It should be remarked, however, that the voice of an announcer will usually emerge from the array rather than from a single speaker. However, those who have listened to this reproducing system for a short time soon become accustomed to these speech characteristics and lose their awareness of it. The speech intelligibility and the high-frequency spectrum in general are cleaner than from a single speaker.

Before going into details on the network characteristics some comment should be made regarding the results of the author's experiments. In general, the better the quality of the speakers the more lifelike will be the illusion. Speakers of less noble peerage may be used, however, with surprisingly good results. Unsuspected liberties may also be taken with certain speaker enclosures without impairing the bass reproduction. However, a good speaker for the highs seems to be a necessity if satisfactory results are to be obtained. It is suggested that the speaker chosen for low frequencies be placed to the right of its companion.

The illusion may be created in a number of ways and to a worthwhile degree using available equipment. Perhaps the simplest and least expensive method is to use two good radio receivers which have been slightly altered. In one, a single high-pass section of the dividing network should be connected between the present output transformer and the speaker. In the companion radio a single low-pass section of a dividing network should be similarly connected. When both altered receivers are tuned to the same station and the proper level established for each set the illusion should be pronounced. Its degree of excellence will be completely dependent upon (*a*) the quality of the broadcast itself, (*b*) the response of the individual sets, (*c*) the skill with which the listener adjusts each set for tonal balance, (*d*) the relative placement of the high-frequency reproducing set with relation to its companion low-frequency reproducing set, and (*e*) the acoustical characteristics of the listening room where the sound outputs will be acoustically recombined in space to form the whole illusion. The latter statement will also apply to any of the combinations to be described.

The separate filter sections should be selected on the basis of the speaker load impedance of each particular set if they differ one from the other. Each section should then be individually designed to operate at the same crossover frequency.

A second method that may be employed is the addition of a two-channel dividing network and loudspeaker to a high quality radio receiver. This receiver should have its own built-in high-quality amplifier and transform-

er-coupled speaker. The built-in speaker may serve as one channel if it is reconnected through the output of the network. The external or outboard loudspeaker is then connected to the remaining network output channel.

If the two speaker load impedances differ, the technique of using single channel networks in each circuit should be adopted.

The third method involves an existing installation which includes high-quality AM, FM, and TV, and a tape machine. The amplifier is a Williamson-type which is flat from 30 to 20,000 cps. The speaker dividing network is a 1200-cycle crossover, 16-ohm, constant resistance type. The highs are delivered by a quality coaxial speaker housed in a good enclosure. Surprisingly, the woofer is a 12-inch speaker which is used in the TV console. The speakers are placed at a 45-degree angle in the opposite corners of a 16-foot wide living room, making the distance between speaker centers about 12 feet. The best listening area, although not sharply defined, is near the center of this room and about six feet from the front wall. Despite the poorly baffled TV woofer the bass is pleasingly solid, natural sounding, and free from objectionable peaks, thumps, and box-barks. When the tweeter highs are attenuated to a good musical balance the illusion created and the sound quality itself are excellent. Orchestral reproduction is such that the instrumentalists seem to be spread across the room. Some new and interesting things were noted as experience with this array accumulated. Individual instruments in an orchestra can be distinguished with uncommon ease. The tamborines, cymbal crashes, drums, bells, brushdrums, and triangles are unbelievably clean and clear. Audience noises, applause, etc., take on a new life-like characteristic. Furthermore, these phenomena are obvious even at a sound level much lower than that at which the orchestra originally recorded the material and much below that used by the average high-fidelity enthusiast operating a single high-grade speaker.

Some humorous by-products were also observed. Before the network and TV speaker were employed in this new system the owner operated his coaxial speaker at the usual audiophile level. His wife either fled the house or forbade the use of the equipment in her presence. Peace now prevails as evidenced by the fact that she uses the system daily for her own entertainment.

We will now take up the matter of the actual construction of the network. Inductance and capacity values are the same for both the high- and low-pass sections where the speaker load impedances are the same in each output. It should be emphasized that values will change according to the crossover frequency chosen and the impedance for which each output of the dividing network is designed. This should be remembered when attempting to use either of the first two applications suggested. The impedance of speakers used in commercial sets varies over a considerable range, hence flexible design data is required. Many of the available speakers are 16-ohm types, consequently the chart is computed on this basis. To find the values for networks of other impedances, choose the desired crossover frequency, read the values indicated for 16 ohms at this crossover, and then multiply that figure by $R/16$ to get the figure for the new inductances. For the new capacity values divide the 16-ohm figure by $R/16$.

The work done to date has used crossovers between 2000 and 300 cps. To suggest a starting place for home experimentation, 900 cps is recommended. This frequency has yielded very satisfactory results.

It will be noted from reference to the chart that the higher crossover regions use capacitors of lower value. These low-capacity units are somewhat cheaper than those of higher capacity. The inductances are variables which are relatively simple to wind and are fairly inexpensive.

Simple air core inductances are best for this application. They may be wound on any removable form having proper hub and flange diameter. If the 900-cycle crossover frequency is chosen, for example, a stamped metal 16 mm film reel may be used as a winding form, then taken apart and removed after winding is completed. This produces a good form factor for this size inductance. 330 turns of #21 heavy "Formvar" wire tightly wound on this form will come close to 4 mhy. After removing the winding form the coil should be tightly lockstitched with waxed lacing cord, then taped, using any good acid-free friction tape, but better still, a half lapped serving of vinyl base electrical tape. These servings of lacing cord and tape make the coil self-supporting and will also avoid inductance changes due to sponginess.

The capacitors should be of the impregnated paper type. They may be 50 or 100 volt types which are standard ratings and readily available. To arrive at the odd values of capacity indicated for some crossover frequencies, it may be necessary to use parallel and/or series combinations. The resultant capacity should be within $\pm 10\%$. Good commercial capacitors fall within this tolerance limit. If an impedance bridge is available, both capacity and inductance values can be checked quite readily.

Perhaps a simple way out of the capacitor value problem is to choose capacitors of nominal ratings and construct the companion inductances, as determined from the chart. For example, two commercially available oil impregnated paper 4 μfd., 100 volt capacitors of the bathtub type may be connected in parallel to give 8 μfd. or thereabouts. Measurement of six bathtub types averaged 3.996 μfd. Reference to the chart indicates a crossover frequency, when using 8 μfd. and 4.1 mhy. inductance, to be about 880 cycles for a 16-ohm network, which is a good crossover frequency for the wanted illusion. Consequently wind the inductances for about 4.1 mhy. 333 turns of #21 heavy "Formvar" or equiva-

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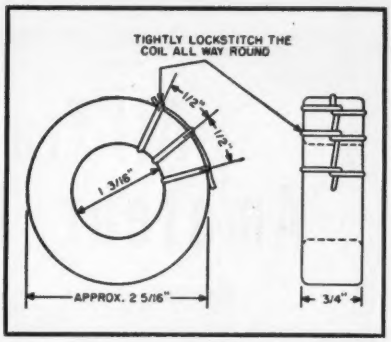
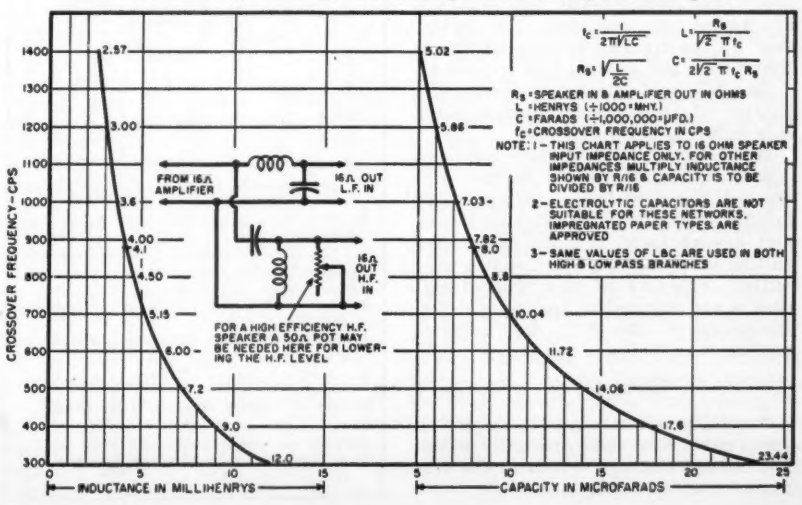


Data for constructing the "900 cycle" crossover. A typical coil is 333 turns of #21 heavy Formvar or Formex. This will produce an air core coil of approximately 4.1 mhy. using dimensions given above. When connected with an 8 μfd. capacitor, as shown below, it should give an f_c of about 880 cps in circuits loaded with 16-ohm speakers.

Chart of constant impedance speaker dividing network for experimental system.



All-Transistor Amateur Transmitter

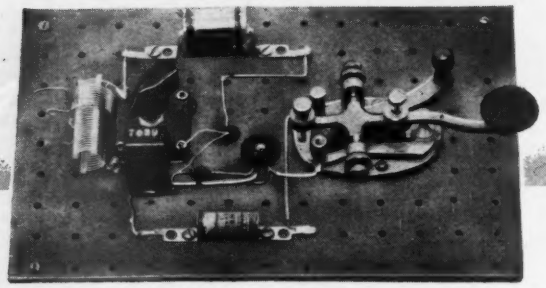


Fig. 1. Over-all view of transmitter. It is built on a perforated Masonite board measuring 8"x12". By using perforations to hold parts, soldering work is minimal.

By **GENE BRIZENDINE,** W4ATE

Build this compact, portable rig for the 40- or 80-meter band. It uses standard transistor components throughout.

AS THE versatile transistor invades more and more electronic fields, the urge grows to explore its possibilities in amateur applications. Admittedly, the project of constructing a useful transistor transmitter was approached skeptically. However, the sporting idea of using very low power in communications brought a fresh viewpoint, similar to fishing with archery equipment, or big-game hunting with a candid camera. Encouraged by reports of two-way communications upward to 2000 miles, the transistor transmitter was undertaken.

Circuit

The base oscillator circuit selected is relatively simple to adjust and none of the components is especially critical. This arrangement also has the advantage of requiring no power switch. The transmitter is ready to go the instant the sending key is pressed.

The 365 $\mu\mu$fd. miniature tuning capacitor (C_1) is of special interest, since it is only 1½" by 3/16" thick!

By mounting the sending key and supply batteries directly on the perforated Masonite board (8" x 12", *Lafayette Radio* Type ML-81), all power and keying leads are eliminated, resulting in a completely portable transmitter. Stability of the emitted signals is not affected by mechanical disturbances of the key, since crystal control is used.

Construction

Assembly is best begun by mounting small parts first, and gradually working toward the key, which is the last item to be mounted.

The tank tuning capacitor is spot-soldered to two spade lugs whose shanks are pressed into the perforated board holes. The eyelet rivets in the capacitor are convenient for this.

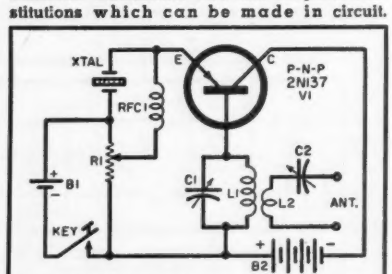
The tank coil is soldered to a lug and one rivet on the tuning capacitor. The 2N137 transistor is mounted by simply pressing its seal end into one of the perforated holes. All other components are bolted to the board, using the ready-made holes.

The antenna pickup coil is slipped over the "cold" or ground end of the tank coil. The two coils are solidly joined, by applying small drops of *Duco* cement where their plastic strips contact.

Rubber "feet" are bolted to each of the board's corners, to protect furniture and prevent movement of the transmitter during keying.

Wiring is simple and best done with a small-tipped soldering iron or gun. Heat should be applied sparingly while soldering in the transistor, potentiometer, and the coils. Leave the 2N137 leads full-length, as additional protection to the sensitive transistor.

Fig. 2. Complete schematic diagram of transistor transmitter. See text for parts substitutions which can be made in circuit.



R_1—500,000 ohm pot (Lafayette Radio Type VC-18)
C_1, C_2—365 $\mu\mu$fd. tuning capacitor (Lafayette Radio Type MS-215)
RFC_1—1 mhy. r.f. choke
L_1—32 t., 3/8" dia., 2" long (Miniductor #3003)
L_2—9 t., 3/4" dia., 3/8" long (Miniductor #3012)
B_1—1.34 volt battery (Mallory Type RM-4010)
B_2—15 volt battery (Burgess Type U-10)
Key—Sending key
Xtal.—7 mc. quartz crystal (See text)
V_1—"p-n-p" junction transistor (General Electric Type 2N137)

Adjustment

A field-strength meter or receiver equipped with an "S" meter is useful in tuning up the transmitter. Lacking either of these, a receiver tuned to the transmitter frequency may serve, by reading its a.v.c. voltage, as a field strength indication.

First, the crystal to be used should be placed in another oscillator or transmitter, and used to locate the receiver or field meter on the correct frequency.

The transistor circuit should be visually checked for any wiring errors and incorrect battery polarities. Now, transfer the crystal to the new transmitter. A 0-10 ma. meter connected in series with the collector may be helpful, although it is not essential.

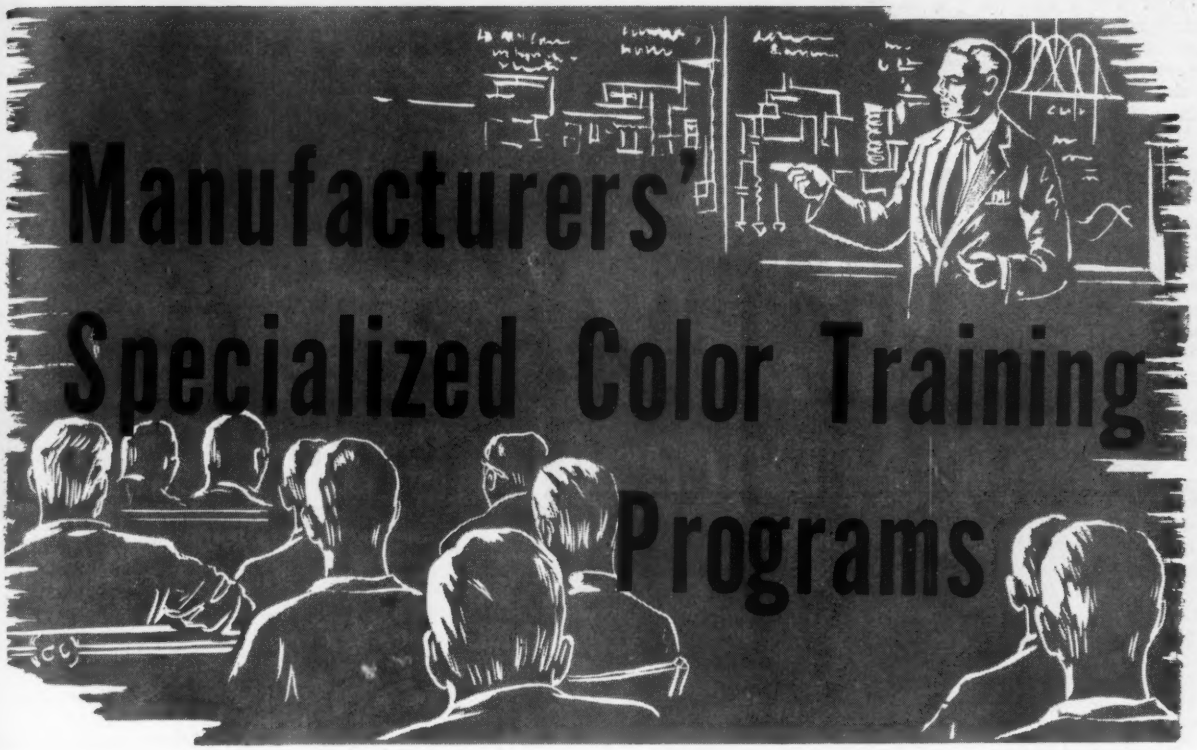
Next, turn the bias potentiometer and tank capacitor fully counterclockwise. While keying the transmitter, explore slowly with the capacitor and pot controls. The carrier should be heard in the receiver with the potentiometer advanced almost fully clockwise, and the capacitor at about 30 degrees from minimum capacity. As either the bias pot or the capacitor is advanced past the optimum point, oscillation will suddenly cease.

If the transmitter is not heard, carefully recheck the connections to the 2N137 and the battery polarities. The crystal should be chosen for good activity.

Although the crystal indicated in the parts list is in the 40-meter band, operation on 80 meters is also possible with this transmitter. It is only necessary to use an 80-meter crystal and to retune the tank tuning capacitor to about two-thirds maximum capacitance. In either band, the approximate input power during normal operation is 75 milliwatts.

When these tests are satisfactory and the keying is clean, a doublet antenna, cut to the operating frequency, may be connected, using a second, similar midget capacitor (C_2) to "tune out" the inductive reactance component of the coupling coil.

With the field-strength meter or "S"-metered receiver tuned to the transmitter, the controls may be adjusted for maximum field strength indications, consistent with clean keying. Once optimum settings of the tank, bias, and coupling controls are found, no difficulty should be experienced, and the transmitter is ready for communication. -30-



Manufacturers' Specialized Color Training Programs

In courses given at all levels, set manufacturers will prepare you, at no cost, to service their sets.

THE stepped-up push to get color receivers into American homes means that you, if you are a technician, must get ready to meet the special demands that will be placed on you. No matter how thorough your background in color may be up to now, there is some additional type of training you need. Some of the newest developments may have slipped by you. The mere fact that you haven't had much opportunity to use what you have learned in color helps it to become stale.

Training programs provided by set manufacturers, generally at no cost, range from practical in-shop residence courses, given at the factory, to local lecture series. Eligibility to take part in a training program may range from employment in the manufacturer's service department to minimum evidence of independent work. Registration may involve formal application direct to the manufacturer or simply putting your name on a local distributor's list. Somewhere in these alternatives, there is a program that suits your needs, availability, and eligibility.

Among those providing local training, *Emerson* sends out field service engineers at regular intervals to conduct two-day lecture courses throughout the country. Coverage of the theoretical and practical aspects of color service includes the use of test equipment in setting up convergence and other procedures unique to color sets. If you are interested in getting in on the next two-day course, get your name on file with the local *Emerson* distributor now.

A one-week course at the factory is the pattern of training provided by *General Electric*. This concentrated course in theory and lab work, with particular attention to the manufacturer's color receivers, calls for six calendar working days with two or three night sessions during the week if needed. Once the student is in Syracuse, no charge is levied for attendance or materials furnished. When inaugurated last July, attendance was confined to *G-E* distributor service personnel. While these people continue to enjoy priority, the course is also open to dealer service personnel and independents. Enrollment is supervised by *G-E* field service representatives throughout the country, who pass upon the suitability of the applicant's previous training and experience. Further information is available from J. R. Davis, Field Service Manager, *General Electric Company,* Bldg. 4, Room 242, Appliance Park, Louisville, Ky.

A clinic course at its factory presently being offered by *Hoffman Radio* is being confined to distributor service personnel. In this way, the manufacturer hopes to qualify distributor technicians to train, in turn, servicing dealers and independent technicians. Locally offered training courses will coordinate with and support the distributors' efforts. *Hoffman* distributors will be the best source of information on how the local program is shaping up and when it is ready to roll.

Successful completion of an entrance exam on monochrome TV theory has been the ticket of admission to color schools held by *The Magnavox Company* for its dealers and authorized service agencies. To accommodate students from all parts of the country, five-day schools were set up in San Francisco, Chicago, and New York, at no charge to the technician who could get to these centers. With no definite date set for the next such series, the manufacturer's service engineers are holding informal lectures in various parts of the country. To follow up on forthcoming offerings in the training program, get in touch with the General Service Manager, *The Magnavox Company,* Fort Wayne 4, Indiana.

Offering factory courses until the middle of last year, *Motorola* has transferred all of its color training activities to the field, with field service engineers collaborating with distributors' service managers in conducting schools and training sessions locally. Local contact with the distributor must be made for participation.

Philco Corp. offers 40 hours of lectures, demonstrations, and lab projects in a comprehensive course that includes a copy of the text "Color Television—Simplified Theory and Service Techniques," which normally retails for $5.00. While the course was primarily planned for members of the *Philco* "Factory Supervised Service" plan, other service personnel may also

(*Continued on page* 130)

Learn to Service All Color Sets

Extensive programs given in training institutions cover all models—all aspects of the new field.

MANUFACTURERS of color receivers have played an impressive role in providing technicians with color training, usually at no cost. Despite these far-flung programs, reputable training institutions throughout the country are enjoying a brisk turnover in students willing to pay for schooling in this same field. In some cases, the paying students are those who have already experienced some form of training provided by a manufacturer. Obviously, the private school must have something special to offer.

One advantage provided by the paying institute is the broader manner in which it surveys the field. A given manufacturer is likely to consider color training adequate or complete when the technician-student has acquired some general background plus reasonable familiarity with that manufacturer's receivers. The well-equipped school will survey as many of the extant receivers as possible.

Class size, instead of involving possibly hundreds under simultaneous instruction, is held to small groups. This permits the benefits of individual instruction and gives the student greater opportunity to engage directly in practical work, using actual chassis and test equipment. Whereas the longer manufacturer-sponsored courses seldom exceed 48 hours of instruction, if they go that high, private courses generally run into the hundreds of hours. Small wonder, then, that the training institution is able to hold its own against other types of training.

If you have had at least a year's experience in black and white television servicing or have successfully completed a course in this area given by a recognized training institution, the *Baltimore Technical Institute* will admit you to a resident course in color TV. Generally following the outline of the course recommended by the Service Committee of RETMA, the program has been enlarged and extended to include recommendations made by other authorities. The newest in color TV circuitry, apparatus, and equipment is used. Running for 500 clock hours, the course takes four months by day, but may also be pursued in the evenings at the rate of two, three, or four nights a week. Applications are accepted throughout the year.

Offering a specialized course in television, with special emphasis on color, *Capitol Radio Engineering Institute* asks for a basic course on electronics and electrical circuit theory as a prerequisite, for this or any of its specialized courses. The inclusive course covers such fundamentals as the mechanism of the eye (persistence of vision, resolution, flicker, and theory of color perception), chromaticity diagrams, and bandwidth requirements. This is followed by instruction in lighting of color studios, frequency multiplexing, the color subcarrier and chrominance signals, color separation, and other aspects of the signals involved. Then the actual studio, transmitter circuits, receiver circuits, and color picture tubes are analyzed.

Color training is part of the regular TV service course at *Coyne Electrical School*. Resident training includes lectures, discussions, demonstrations, films, and texts, with half of training time being devoted to work with receivers, tools, and test instruments. Special jobs on color sets are planned to qualify the student for making all required home-installation adjustments and for troubleshooting color chassis on the bench. A home training course consisting of illustrated lesson material includes special lessons on color, together with practical "job guides" giving detailed service procedures.

A separate course in color is available to graduates of regular TV courses or adequately experienced technicians at the *Delehanty Institute*. It consists of 120 hours of lectures and demonstrations, with specialists handling the several areas covered. These include color TV fundamentals, two-phase modulation, the NTSC system, colorimetry, and the color signal. Also covered are color receivers and circuits, picture tubes, mechanical and electrical adjustment, special test equipment, and the practical problems of alignment, servicing, and troubleshooting the color TV sets.

Principles of color TV are included as part of both the resident and home training programs in television servicing at *DeVry Technical Institute*. Among the subjects covered are color TV signals and picture tubes, circuits for the shadow-mask tube, color demodulation, color sync circuits, special test equipment, receiver installation and alignment. Those who attend the resident program have the advantage of working with name-brand receivers

and test equipment, the latter including dot and bar generators. In addition, broadcast-type equipment in the school's studios make locally generated color signals available whenever they are needed.

Greatest emphasis is being placed on set-up and service in the home at the *Electronic Trades Institute.* This approach grows out of the feeling that, considering chassis size and the delicacy of adjustments, more actual work on color receivers will be performed in the home than has been the case with their monochrome forebears. Color receivers, including the latest 21-in. models, are used, along with dot and color bar generators. Each student has the opportunity to become directly familiar with the purity, convergence, and other procedures in the complete set-up. While this course is available to resident students during the day, a short course similar to it is offered to local service technicians in the evening.

Indianapolis Electronic School offers a complete resident course that includes color TV circuits and servicing. The 12-month, 1300-hour course is broken up into four sections, the last of which, Section III-C, involves 325 hours in color TV theory and circuitry. Other training equivalent to the first three sections (these cover electronic fundamentals, basic theory and circuitry, advanced circuit theory, and TV receivers) may be accepted for admission to Section III-C. Evening classes are offered on a half-time basis for those who work while attending school.

To keep abreast of color developments as they occur, *National Schools* keeps its courses of study, both in the resident and home study divisions, as flexible as possible. Basic to the course, however, is the method of comparing the unknown color receiver to the known monochrome instrument, with treatment of similarities and differences, a breakdown of new and additional circuits, and coverage of new test instruments and servicing techniques. This involves a description of the NTSC system, colorimetry, vector analysis, signals, receivers and their special circuits, picture tubes, and conversion circuits.

Practical home-study courses, based on actual work with equipment kits, are featured on two levels by *National Radio Institute.* In each case, color training is part of a broader course that covers the entire field of TV service. The course in radio and TV servicing provides basic theory, then progresses to detailed study of monochrome and color TV, with actual practice on common receiver circuits. For men who know their theory but are seeking additional skill and speed, there is the all-practice course, professional TV servicing, which involves work on 10 kits, including a receiver and test equipment, as well as special instruction in color.

In the resident school of *RCA Institutes,* a firm base of fundamental principles is laid down to give understanding of the design and operation of the color receivers and of the transmitting station functions employed in producing color transmissions. Color set servicing is included, in addition, on all levels of instruction. A broadcasting course also covers this ground but includes principles and equipment involved in generating and transmitting color signals. An advanced technology course also adds analysis of design and operation. In the home study division, a series of eleven lessons in color is available to those already qualified in black-and-white television. The last two lessons, recently released, keep the course in step with latest developments.

The step-by-step approach found successful in teaching its other correspondence electronic courses has been applied by the *Radio-Television Training Association* to its lessons in color receiver service and maintenance. The student proceeds from the development and transmission of color signals to an over-all view of how the receiver functions, followed by separate analysis of receiver circuits. Analysis is emphasized in preference to rote learning. Training in test equipment, alignment, and service is included.

The special six-week resident course given by *Universal Television System* has been approved by the Missouri State Dept. of Education. Comprising 180 clock hours of lectures and demonstrations, it is a separate and special course in color apart from monochrome TV and, as such, is one of the earliest to have received official endorsement. Approval was given in June of 1954. Lectures are augmented with over 400 color slides and accompanying tape-recorded commentary.

Up-to-the-minute servicing techniques and shortcuts are included in the coverage of all aspects of color TV at *Video Specialties, Inc.* After a study of fundamentals, the student is instructed in all color stages, circuit functions, modifications in late models, and in troubleshooting techniques. The emphasis is on practical lab training, with most school hours being devoted to work on live sets. This work consists of circuit tracing and repair, involving the use of appropriate modern test equipment.

While the institutions already mentioned are not the only ones to offer courses in color TV, training in this area available from other educational organizations is not on the service level. Such other schools include *Cleveland Institute of Radio Electronics, Milwaukee School of Engineering,* and *Tri-State College.* In the first mentioned, correspondence courses are offered in basic communications. Color TV is touched on in this program, but principal emphasis is on electronic theory and communications technique. At the *Milwaukee School,* there is a choice of day and evening residence courses. The daytime program is an 18-month technician training course leading to the Associate in Applied Science degree in Electronics Communications. This course includes study in monochrome and color transmitters and receivers, as well as in other types of receivers and the basic theory and practice of electronics. The evening course in color covers the physics of color, the receiver, and receiver circuits that are peculiar to color sets.

At *Tri-State College,* a resident course is given that leads to a degree in radio engineering. It includes credits in both monochrome and color TV.

For the prospective student, there is a wide enough choice to meet any study requirements. —30—

Write to registrars of the schools below for full information on color courses.

Baltimore Technical Institute
1425 Eutaw Place
Baltimore 17, Maryland

Capitol Radio Engineering Institute
3244 16th Street, N. W.
Washington 10, D. C.

Cleveland Institute of Radio Electronics
4900 Euclid Avenue
Cleveland 3, Ohio

Coyne Electrical School
500 S. Paulina Street
Chicago 12, Illinois

The Delehanty Institute
117 East 11th Street
New York 3, New York

DeVry Technical Institute
4141 Belmont Avenue
Chicago 41, Illinois

Electronic Trades Institute
431 South Dearborn Street
Chicago 5, Illinois

Indianapolis Electronic School
312 East Washington Street
Indianapolis 4, Indiana

Milwaukee School of Engineering
1025 North Milwaukee Street
Milwaukee 1, Wisconsin

National Radio Institute
16th and U Streets, N. W.
Washington 9, D. C.

National Schools
4000 South Figueroa Street
Los Angeles 37, California

RCA Institutes, Inc.
350 West 4th Street
New York 14, New York

Radio-Television Training Association
52 East 19th Street
New York 3, New York

Tri-State College
16106 College Avenue
Angola, Indiana

Universal Television System
1224-28 Admiral Boulevard
Kansas City 6, Missouri

Video Specialties, Inc.
4570 Firestone Boulevard
South Gate, California

By BERT WHYTE

AS MOST readers know, the majority of high-fidelity equipment manufacturers have banded together and formed a trade organization known as the "Institute of High Fidelity Manufacturers". The aims and purposes of this group I reported on some months ago. One of their objectives was to sponsor hi-fi shows in the various major market areas. These shows were to supplant the Audio Fairs which we have had for the past 7 years. The whys and wherefores of this are too complicated to discuss and it is not my business to try and analyze the reasons. Suffice to say that the Audio Fair is no more and on Sept. 27 through 30 the Institute held its first New York High Fidelity Show. Inevitably, one must compare it with the Audio Fairs of recent years. First round goes to the new Institute Show, the sponsors very sensibly holding the show much earlier than did the Audio Fair and thus giving the hi-fi dealer a longer marketing period for the new equipment.

There was a lot said about the new location of the show which is the New York Trade Show Building. It was highly touted as being very superior in facilities available as compared to the former site of the Audio Fair in the New Yorker Hotel. Well, I'd call this round a draw. It was true as advertised that the hallways were much more spacious, the fluorescent lighting much easier on the eyes. One of the major attractions was supposed to be the air-conditioning, but during all the time I was there, I didn't notice any appreciable difference. . . . I was as hot and sticky as in former years. And while a few of the more fortunate manufacturers had acquired rooms which were far larger than anything the New Yorker ever had to offer, on the whole the rooms were disappointingly small. It looked rather ridiculous to see some of the most gargantuan speakers in these tiny rooms. More than that and my main objection was that all the rooms were exceedingly hard sounding as might be expected with vinylite floor covering and hard plaster walls. The New Yorker rooms with carpeting on the floor would have greatly aided in subduing the merciless treble screech some of the more peakier speakers were putting forth! But by and large, the first Institute show was a success. Despite the fact that admission (50 cents afts.—75 cents eves.) was charged, the crowds were greater than ever. Here is where the Institute really shone, their handling of these crowds very much more efficient and well organized than ever obtained at the New Yorker.

This year the people who attended the show seemed a more reasonable breed than their predecessors. They were generally more knowledgable about hi-fi, and seemed more concerned with good musical balance than with the spectacular tricks and "gimmicks" of yesteryear. Perhaps the most amazing thing was that the levels at which the equipment were demonstrated did not increase as they have cumulatively in past years, but were actually quite reasonable. On an overall basis, there wasn't a great deal of new equipment at the show and certainly nothing world-shaking turned up. This is evidently the year of re-design . . . facelifting and restyling . . . and technical refinement. However, there is absolutely no basis for any ideas about the stagnation of hi-fi design and engineering.

To help harried hi-fi Santas, I'll have to keep the reviews short as I want to list as many records as possible as an aid to your Christmas buying. Most of the records reviewed will be new material, but some will be older discs in the catalogue which are outstanding recordings and have special values as gifts.

To all of you . . . my favorite people . . . a very Merry Christmas to you and yours and best wishes for a joyful holiday season!

Equipment used this month: New *Weathers* arm, cartridge, and oscillator; *Marantz* and *McIntosh* preamps; *Components Corp.* turntable; 2-60 watt *McIntosh* amplifiers; *Jensen* "Imperial" speaker; *Electro-Voice* "Georgian" speaker, *Ampex* monaural/stereo tape equipment.

BEETHOVEN
SYMPHONY #3 (EROICA)
Philharmonia Orchestra conducted by Otto Klemperer. Angel 35328. RIAA curve. Price $4.98.

It is too bad this version of the "Eroica" follows so hard on the heels of the excellent Fritz Reiner reading of some months ago. If you bought that recording you can be assured that performance and soundwise you have one of the very best versions available. But if Beethoven is your pet, if the "Eroica" is close to your heart . . . then you cannot afford to ignore this recording. For along with the Toscanini performance, this is one of the greatest readings ever committed to disc. And with the added plus of magnificent modern sound it is without question the finest "Eroica" in the catalogue. Klemperer is a giant here, this is a reading of incredible power and vitality. The passionate utterances of the 1st, 3rd, and 4th movements are projected with great intensity, yet Klemperer never overplays, he is never mannered. And the dolorous broodings of the 2nd movement, the famous "Marche Funebre", Klemperer approaches with great reverence. His tempo is slow, measured, but he never allows matters to go beyond the bounds of good taste. And the playing Klemperer elicits from the men of the Philharmonia is truly wondrous.

Soundwise, this is hugely proportioned, one of the biggest sounds *Angel* has thus far produced. First and second strings are beautifully clean and well defined and the dark sonority of the celli and contrabassi must be heard to be believed. Add great resounding brass, lovely mellow woodwind and percussion of great impact and accuracy and couple with the most felicitous of acoustic perspective and you have a recording of near definitive proportion. I can't recommend this too highly!

MOZART
CONCERTO #25
CONCERTO #26
Friedrich Gulda, pianist, with New Symphony Orchestra of London conducted by Anthony Collins. London LL1370. RIAA curve. Price $3.98.

A fine coupling, sensitive and more than satisfactory performances from Gulda, Anthony Collins a little out of his element but doing a creditable job nonetheless, and exemplary sound in the proper light frame for Mozart . . . all adds up to one of the better Mozart releases in this year of surfeit.

BRAHMS
SYMPHONY #4
Philharmonia Orchestra conducted by Herbert Von Karajan. Angel 35298. RIAA curve. Price $4.98.

This Brahms 4th is heroic in line and conception. Von Karajan makes of it a great sonorous edifice which will appeal to many and not at all to others. Taste aside this is a real conductorial *tour-de-force* with playing of miraculous precision. Big clean sound from *Angel* to match the grandiose efforts of Von Karajan.

BIZET
SYMPHONY IN C MAJOR
JEUX D' ENFANTS
London Symphony Orchestra conducted by Emanuel Young. Capitol P18018. RIAA curve. Price $3.98.

Bizet's scintillating symphony and his ingratiating "Children's Games" are given a warm and sympathetic reading by newcomer Young, who obviously is a conductor of considerable merit. His reading lacks some of the *vivo* of the Cluytens/*Angel* version, but soundwise his engineers have done a fine job in coming up with just about the cleanest disc yet in *Capitol's* European series.

RUBENSTEIN PLAYS LISZT
Artur Rubenstein, pianist. Victor LM-1905. RIAA curve. Price $3.98.

Take bravura repertoire, a Rubenstein at the top of his form, add a "big" piano sound of startling brilliance and you have pianism in "le grande tradition". Rubenstein has the happy faculty, that when he is "right", he can take works like the "Mephisto Waltz", the "Hungarian Rhapsodies" 10 and 12, and even the ubiquitous "Liebestraum" . . . all found on this disc . . . and done to death though they may be . . . make them sound fresh and interesting. One of the best piano recordings musically and technically ever issued by *RCA Victor*, and a "must" to demonstrate piano sound on your hi-fi system.

SAINT SAENS
SYMPHONY #3 (ORGAN)
Henriette Roget, organist, with Orchestre de la Societe des Concerts du Conservatoire de Paris conducted by Andre Cluytens. Angel 35336. RIAA curve. Price $4.98.

This is the 5th recording of this popular work and in all respects the best. This recording was awarded a Grand Prix du Disque

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

and one listen to it, and I am in complete accord. Cluytens approaches the work with respect (which few other conductors do) and his affection for it allows a warm and lyrical reading, flawlessly executed. Oddly enough, although this has by far the best and cleanest sound of any of the present versions, it too lacks the extremely low organ pedal, which so endeared the old Munch/*Columbia* reading to the hi-fi fan. Whether it was chance or circumstance or recording trickery, none of the recordings since then has captured the shuddery, soul satisfying throb of the organ pedal as it was captured on the old Carnegie Hall organ. This aside, this is a most exciting recording and highly recommended to you.

VIRGIL FOX PLAYS BACH

Virgil Fox, organist, playing the organ of the Riverside Church, New York. Victor LM1963. RIAA curve. Price $3.98.

The critics have murdered poor Virgil for this one, and in all honesty I must admit that his playing of Bach is not always according to the score nor the accepted standards of performance. However, Fox has a tremendous talent for communication and he can make Bach acceptable and assimilable to many who otherwise would never give Bach a second thought. The "Toccata and Fugue in D Minor" is such a dazzling work it always has a great impact on an audience, however musically unsophisticated the audience might be. But it takes a real showman to make that same audience accept and like Bach works like the Chorale preludes. Yes, Fox is flagrantly guilty of romanticizing and oversentimentalizing these works but, believe me, the audience generally eats it up! The proof of this pudding is that Fox is one of the few money-making touring organ virtuosi on the concert-hall circuit. I know whereof I speak, as several years ago, he drew an audience of close to 2500 people in Orchestra Hall, Chicago, where I had the pleasure of recording his program stereophonically! Recordingwise, this is a huge organ sound with great gut-rumbling pedals much in evidence for the pleasure of the hi-fi fan.

BEETHOVEN
LEONORE OVERTURES #1, #2, #3
OVERTURE TO FIDELIO
OVERTURE TO CORIOLAN

Boston Symphony Orchestra conducted by Charles Munch. Victor LM2015. RIAA curve. Price $3.98.

A magnum sampling of Beethoven Overtures and a fine opportunity to compare the first three overtures written for Leonore with the fourth and final one chosen for the opera which was renamed "Fidelio". Munch turns in deft, if hardly definitive, performances of these overtures, aided and abetted by the virtuoso playing of the Boston Symphony men. Big plus here is the sound which is all luster and sheen, crisp definition, and weighty sonority. This was probably recorded in stereo and the tape should be a knockout!

SCOTS GUARDS ON PARADE

The Regimental Band and Massed Pipers of the Scots Guard conducted by Lt. Col. S. Rhodes. Pipe Majors J. S. Roe and R. Crabb. Angel 35337, RIAA curve. Price $4.98.

Aye mon, the laddies are at it agin. A Scotsman knows a good thing when he sees it and having made more than a few farthings with the first Scots Guard recording, they would like to divest their "yonkee" friends of a few more bob. That they will succeed I have no doubt as this is on the same order of excellence and excitement as the first effort. Unlike so many other sequels,

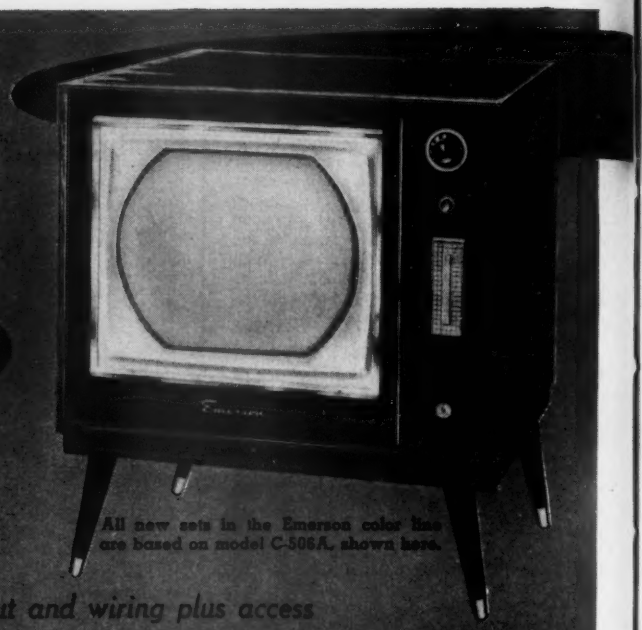
(*Continued on page* 167)

A CHRISTMAS RECORD BUYING GUIDE

A listing of some of the outstanding recordings of the past year which are sure to please the real audiophile.

COMPOSER	TITLE	ARTIST AND LABEL
Beethoven	Ninth Symphony	Toscanini—Victor
Beethoven	Ninth Symphony	Von Karajan—Angel
Beethoven	Violin Concerto	Milstein—Capitol
Bartok	Concerto for Orchestra	Doratí—Mercury
Berlioz	Romeo and Juliet (Complete)	Munch—Victor
Berlioz	Symphonie Fantastique	Doratí—Mercury
Berlioz	Symphonie Fantastique	Munch—Victor
Block	Schelomo	Navarra—Capitol
Brahms	Violin Concerto	Milstein—Capitol
Brahms	Violin Concerto	Heifetz—Victor
Brahms	Four Symphonies (Complete)	Walter—Columbia
Britten	Young Persons' Guide to the Orchestra	Doratí—Mercury
Chavez	Toccata for Percussion	Slatkin—Capitol
Copeland	El Salon Mexico	Fiedler—Victor
Copeland	Third Symphony	Doratí—Mercury
Debussy	La Mer	Toscanini—Victor
Debussy	Le Martyre de St. Sebastien	Danco—London
Dukas	La Peri	Ansermet—London
Dukas	Sorcerer's Apprentice	Paray—Mercury
DeFalla	Three Cornered Hat (Complete)	Ansermet—London
Franck	Symphony in D Minor	Paray—Mercury
Franck	Symphony in D Minor	Furtwangler—London
Gliere	Symphony No. 3	Scherchen—Westminster
Gould	Dance Variations	Stokowski—Victor
Gould	Latin American Symphonette	Hanson—Mercury
Handel	The Messiah	Boult—London
Haydn	The Creation	Woldike—Vanguard
Hindemith	Mathis Der Maler	Ormandy—Columbia
Hindemith	Symphonic Metamorphosis	Kubelik—Mercury
Holst	The Planets	Sargent—London
Holst	The Planets	Boult—Westminster
Ibert	Ports of Call	Paray—Mercury
Khachaturian	Piano Concerto	Kapell—Victor
Khachaturian	Violin Concerto	Oistrakh—Angel
Kodaly	Hary Janos Suite	Solti—London
Kodaly	Peacock Variations	Doratí—Mercury
Liszt	Les Preludes	Paray—Mercury
Liszt	Todtentanz	Katin—London
Mahler	Symphony No. 1	Kubelik—London
Mahler	Symphony No. 1	Walter—Columbia
Mendelssohn	Violin Concerto	Milstein—Capitol
Mendelssohn	Symphonies No. 3 and No. 5	Mitropoulos—Columbia
Mozart	The Magic Flute	London
Mozart	Don Giovanni	London
Mozart	Marriage of Figaro	London
Mozart	Cosi Fan Tutti	Angel
Mozart	Symphonies No. 36, No. 39, No. 40, No. 41	Reiner—Victor
Moussorgsky	Pictures at an Exhibition	Kubelik—Mercury
Moussorgsky	Night on Bald Mountain	Stokowski—Victor
Moussorgsky	Boris Godounov (Complete)	Victor
Offenbach	Gaite Parisienne	Fiedler—Victor
Paganini	Violin Concerto No. 1	Francescatti—Columbia
Paganini	Violin Concerto No. 1	Ricci—London
Piston	Symphony No. 3	Hanson—Mercury
Prokofiev	Alexander Nevsky	Rossi—Vanguard
Prokofiev	Buffon Suite	Golschmann—Capitol
Prokofiev	Piano Concerto No. 3	Kapell—Victor
Prokofiev	Lt. Kije Suite	Boult—London
Puccini	Madame Butterfly	Callas—Angel
Puccini	Tosca	Callas—Angel
Puccini	Turandot	Tebaldi—London
Puccini	Manon Lescaut	Tebaldi—London
Rachmaninoff	Piano Concerto No. 2	Anda—Angel
Rachmaninoff	Rhapsody on a Theme of Paganini	Katchen—London
Rachmaninoff	Symphony No. 2	Steinberg—Capitol
Ravel	Bolero	Paray—Mercury
Ravel	La Valse	Paray—Mercury
Ravel	Daphnis and Chloe (Complete)	Doratí—Mercury
Ravel	Scheherazade	Danco—London
Resphigi	Feste Romana	Doratí—Mercury
Resphigi	Pines and Fountains of Rome	Doratí—Mercury
Reubke	Sonata on the 94th Psalm	Biggs—Columbia
Rimsky-Korsakov	Antar	Ansermet—London
Rimsky-Korsakov	Antar	Paray—Mercury
Rimsky-Korsakov	Capriccio Espagnole	Paray—Mercury
Rimsky-Korsakov	Russian Easter Overture	Paray—Mercury
Rimsky-Korsakov	Scheherazade	Doratí—Mercury
Rimsky-Korsakov	Scheherazade	Ansermet—London
Schubert	Unfinished Symphony	Munch—Victor
Schubert	Symphony No. 7 in C Major	Boult—Westminster
Schumann	Piano Concerto	Gieseking—Angel
Schumann	Symphony No. 4	Paray—Mercury
Shostakovich	Symphony No. 5	Rodzinski—Westminster
Shostakovich	Symphony No. 10	Mitropoulos—Columbia
Sibelius	Symphony No. 2	Collins—London
Sibelius	Symphony No. 3	Collins—London
Sibelius	Symphony No. 4	Von Karajan—Angel
Smetana	My Fatherland (Complete)	Kubelik—Mercury
Strauss, R.	Also Sprach Zarathustra	Reiner—Victor
Strauss, R.	Don Juan	Reiner—Victor
Strauss, R.	Till Eulenspiegel	Krauss—London
Strauss, R.	Ein Heldenleben	Reiner—Victor
Strauss, R.	Ein Heldenleben	Doratí—Mercury
Strauss, R.	Salome (Complete)	Goltz—London
Stravinsky	The Rite of Spring	Doratí—Mercury
Stravinsky	Petrouchka	Scherchen—Westminster
Stravinsky	Petrouchka	Doratí—Mercury
Stravinsky	Petrouchka	Ansermet—London
Tchaikovsky	Manfred Symphony	Kletski—Angel
Tchaikovsky	1812 Overture	Doratí—Mercury
Tchaikovsky	Nutcracker Ballet (Complete)	Doratí—Mercury
Tchaikovsky	Swan Lake (Complete)	Doratí—Mercury
Tchaikovsky	Sleeping Beauty (Complete)	Doratí—Mercury
Vaughn Williams	Job	Boult—London
Vaughn Williams	Sinfonia Antarctica	Boult—London
Verdi	Requiem	De Samata—Angel

Service Features of the New Emerson Color Sets



All new sets in the Emerson color line are based on model C-506A, shown here.

Convenient chassis layout and wiring plus access to adjustments and key points are service boons.

THE current line of *Emerson* color receivers consists of v.h.f. model C-506A (chassis 120319-A) and its u.h.f.-v.h.f. counterpart, model C-507A (chassis 120320-A). The model C-507A looks exactly like the C-506A pictured here except for the appearance of the tuner knobs.

As the block diagram of Fig. 2 shows, the basic circuitry of all color receivers, including *Emerson's,* does not differ much from that of *Admiral, Hoffman, Westinghouse,* and other receivers that are based on the *RCA* color receiver circuits. The circuit was described in the March 1955 issue of this magazine. Some modifications and innovations have been made, but the critical color circuits are still the high level triode demodulators, the crystal-controlled 3.58-mc.-subcarrier oscillator, and reactance tube/phase-detector color-synchronizing system. The convergence circuit is almost identical to those found in other color sets which use the 21AXP22 shadow-mask color picture tube.

The most outstanding contribution of the *Emerson* design to the TV service industry is in the arrangement of the secondary controls, the alignment and adjustment points, and in the over-all mechanical layout.

A novel h.v. interlock is used, which consists of a plastic hollow rod that separates two contacts. When the back cover is removed, the plastic rod is withdrawn and the high voltage is shorted to ground. This grounding contact must be opened with a dummy plug before a regular "cheater" line cord is used; otherwise the flyback transformer or some other portion of the h.v. supply could be damaged.

A glance at the underside of the *Emerson* color chassis will show that it very closely resembles the familiar chassis wiring of monochrome sets. At the time of writing, no printed-wiring sub-assemblies were being used. These models featured conventional components and chassis layout.

The picture tube is shipped in place, and is mounted independently of the chassis. The entire assembly is quite heavy, but not much more than a 21-in. monochrome tube and separate chassis. For most service and trouble-shooting work, however, the chassis need not be removed, since the rear as well as the front and the top of the cabinet are removable for servicing. Accessibility of parts is further improved by the use of a removable plate at the bottom of the chassis. A total of 28 different tuning and adjustment functions are available from the front of the set, most of them hidden by the sub-panel.

Adjustment and Controls

When the hinged customer-adjustment panel is opened, two wood-screws are exposed which hold the removable sub-panel in place. Fig. 1A shows all of these adjustments and their respective functions.

In addition to the front controls there are 11 adjustments available at the rear of the chassis, as shown in Fig. 1B. The focus potentiometer is located inside the h.v. cage, as is usual in color TV sets. Note the horizontal size switch at the bottom rear of the chassis. This switch, which has three positions, connects the horizontal width-control coil for three different picture widths, compensating for line voltage variations and aging conditions.

Also shown in Fig. 1B are tie-points used in alignment and troubleshooting procedures. A quick oscilloscope check at each of the three picture-tube grids, for example, will show whether color video signals are present. The voltage at the cathode of the horizontal output tube serves as indication of proper horizontal sweep power. When a color strip is transmitted on monochrome telecasts, the edge of the picture can be observed by shorting out the indicated test point in Fig. 1B and moving the entire picture off center.

Color purity is obtained by the same components used with most 21AXP22 picture tubes, the purity magnet and the field equalizing assembly. The latter component has a rough adjustment through a radial push-pull action, and a fine adjustment by rotary motion. At the start of the purity adjustment, all magnets are pulled farthest from the rim of the picture tube and the two tabs of the purity control are set to overlap each other. This provides minimum corrective action. A gradual increase and step-by-step adjustment procedure usually permits good color purity to be obtained.

Recommended Test Instruments

In addition to the test instruments normally used by TV technicians, certain special items are required for any thorough alignment and troubleshooting of a color receiver. Oscilloscopes used only for alignment need not be of the wide-band variety, but for rapid troubleshooting a wide-band scope will be invaluable.

The *Emerson* service notes are planned for use without a special scope and require only the standard v.h.f., u.h.f. and i.f. sweep generator,

By ROBERT B. GARY

scope, and v.t.v.m. for the monochrome receiver sections. To align the color portions and check receiver performance, *Emerson* recommends the use of a dot generator with r.f. output, a color bar generator with r.f. output, and a 50-kv. probe for the v.t.v.m. The use of a line voltage monitoring meter is recommended, since the h.v. adjustments should be made with consideration of the a.c. line. For waveshape observation, a low-capacity probe is required and a crystal diode probe is also helpful, but both of these items are usually available in the service shop.

Probably unique among the leading manufacturers, *Emerson* provides a considerable number of fuses in its color sets. "B+" and filament short circuits will be indicated whenever the respective fuses are open. Two fuse-

(*Continued on page* 169)

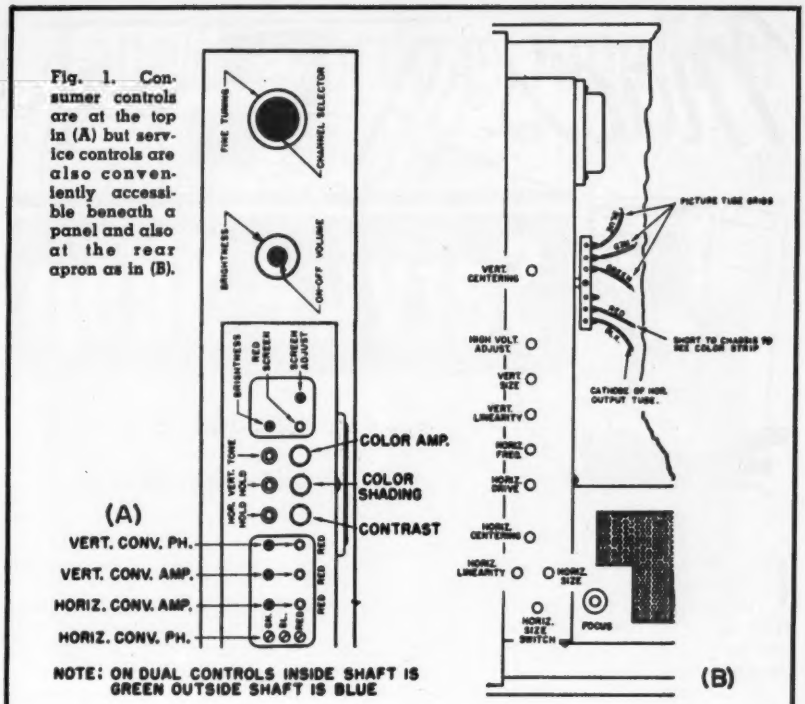
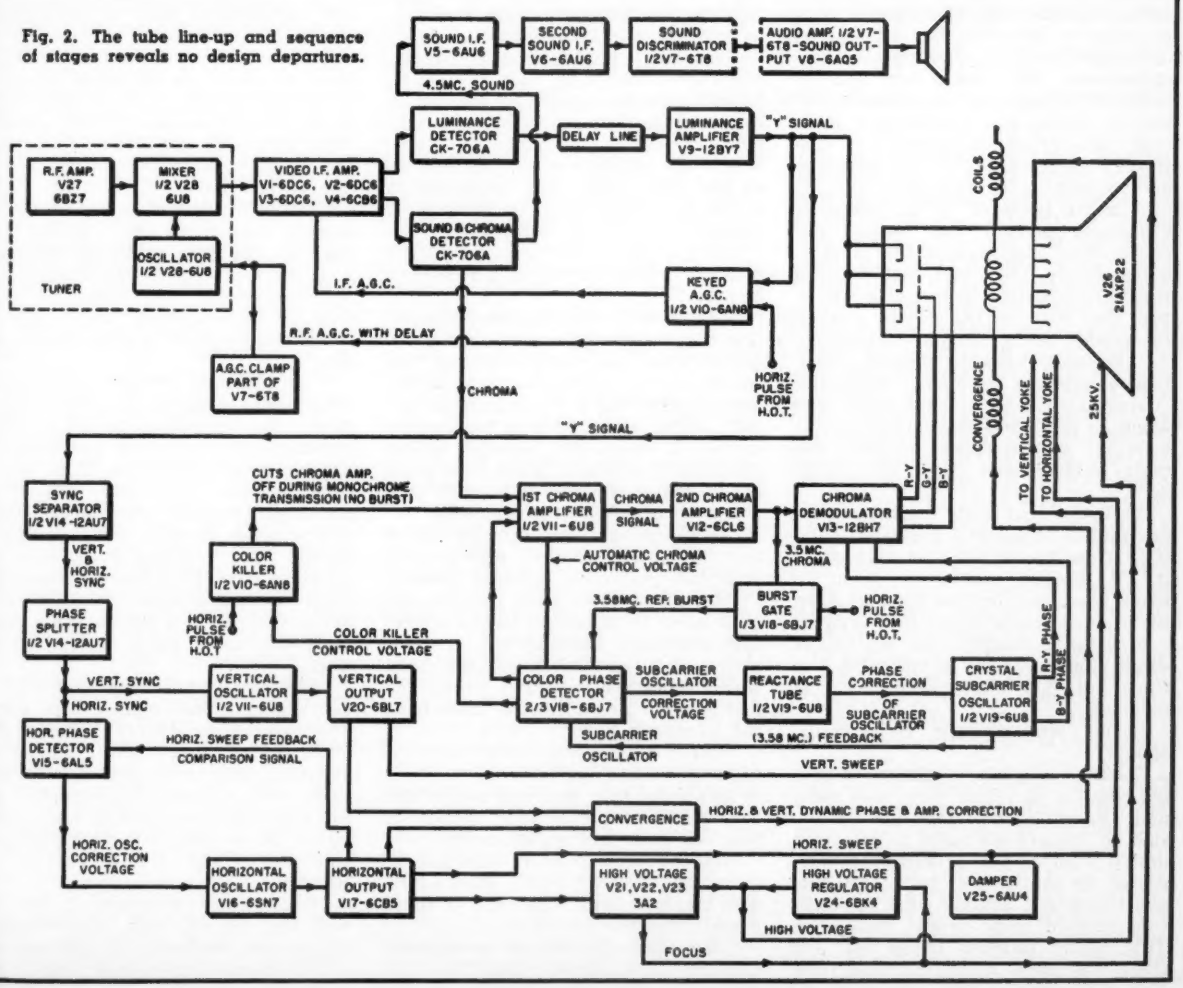


Fig. 1. Consumer controls are at the top in (A) but service controls are also conveniently accessible beneath a panel and also at the rear apron as in (B).

Fig. 2. The tube line-up and sequence of stages reveals no design departures.



By JOHN T. FRYE

"DO-IT-YOURSELFERS"

IT WAS a typical December day. In the morning the sun had shone briefly, but then it clouded up and now scattered snowflakes were blowing against the steaming windows of Mac's Service Shop.

Inside Mac and his apprentice, Barney, were fresh out of work. At Mac's urging, they had really been slaving away at forced draft for several days in order to have the shop all cleaned out and ready for the pre-holiday rush of business. Mac was a firm believer in being prepared to give the "extra" service during this period that could spell the difference between a customer's having a perfect Christmas or one marred by a dead radio, TV, or hi-fi in the home or by an electronic Christmas present that would not work. They had gone at the thing so industriously that they had worked themselves completely out of a job; so now they were seated side by side on the service bench chatting contentedly.

"I certainly hated to miss that technicians' meeting last night," Mac said; "but you just don't leave your wife alone on her wedding anniversary—at least not if you expect to have any more anniversaries. How did things go?"

"It was a real lively meeting," Barney said as he pulled a dog-eared notebook from his pocket and glanced at it. "I thought you would want to know what went on; so I jotted down some notes. Since I was the youngest guy there, I thought the old timers would appreciate my keeping my yap shut; but that didn't keep me from listening."

"What was all the conversation about?"

"About the growing number of people who try to repair their own radio and TV sets. Jim Barker got up and said he thought we ought to present a united front on this problem. He suggested we talk it over in the meeting and thresh out exactly what our attitude toward these people should be. That really touched things off, and there was never a dull moment from then until the meeting was gavelled closed at eleven-thirty."

"I can well imagine," Mac said. "That's a pretty tender subject with some of the boys. What did you decide?"

"Nothing really. We're going to take up where we left off at the next meeting. There was a pretty broad gulf between the extremes of opinion."

"How about a ferinstance?"

"Well, for instance, Dick Boyd really wanted to get rough with the Do-It-Yourselfers. To his way of looking at it, they were trying to take bread right out of his mouth, to scab on the union, and to get themselves electrocuted all at the same time. Any measures to discourage them were, to his way of thinking, more than justified."

"Sounds like Dick," Mac said with a chuckle. "What measures did he have in mind?"

"Oh, he had some dan-dan-dandies. One was to give the people misinformation when they came asking for free advice. If the symptoms sounded like something wrong in the horizontal circuit, advise them to look for trouble in the i.f. stages, etc. Another bright idea was to 'overlook' a bad tube when one of these free-loaders brought in a whole set of tubes to be checked."

"That's going pretty far. On top of that, it's cutting off your nose to spite your face. After all, a sale is a sale."

"Not always. As Dick pointed out, quite often these fellows have a wholesale catalogue sticking out of their rear pocket; and after you tell them which tubes are bad, they thank you and go home and order the tubes from the wholesale firm."

"That's a possibility, it's true; but after they finally do find out you failed to locate the tube that was really bad, they'll have a pretty poor opinion of you and your test equipment."

"Another guy pointed that out to Dick, but he stubbornly insisted he didn't give a hang what one of these cheapskates thought of him."

"How about the rest of the fellows? Did they go along with Dick?"

"Not many of them. Old Mr. Elkins had just about the opposite view. He thought we ought to do everything possible to help the Do-It-Yourselfers in order to secure their good-will—even to lending them schematic diagrams and helping them diagnose their troubles. He insisted that in the long run this would pay off. If we impress the Do-It-Yourselfers with our honesty and desire to be helpful, sooner or later he will realize how foolish it is to try and do service work without the know-how, the service literature, or the test equipment. Then he will bring his set to us because he has learned to trust us."

"Hm-m-m-m," Mac said dubiously. "That sounds pretty good and noble, but I'm afraid Mr. Elkins does not appreciate how hard some of these fellows are to discourage. And I flatly refuse to let any of them see our service literature. After all, we have invested several hundreds of dollars in our schematics; and I'm not about to let one of these jokers use them for free. I wouldn't even let another technician make a practice of that. To do so would be stupid.

"Neither do I intend to hand out any free advice on how to correct trouble in a set. That would be giving away our most valuable asset: our know-how. In such a case, if we guessed wrong—and you know how easy it is to make a mistake about symptoms relayed to you by an untrained person—all we'd get is the suspicion and ill-will of the Do-It-Yourselfer. If we guessed right, we'd just show how 'smart' we are by doing ourselves out of a possible service job."

"That's about the way most of the fellows seemed to feel. While they were not ready to go along with Dick in actually misleading the Do-It-Yourselfers or giving them dishonest tests, they felt it was being mighty foolish to aid these people in fixing their own sets.

"Carl Marshall brought up an interesting point, though. He said it was a case of the pot calling the kettle black because every one of us was a Do-It-Yourselfer in other lines. Some of us work on our own cars; others do plumbing around the house; still others make changes in their house wiring. And in about every instance we do exactly what the radio and TV Do-It-Yourselfer does: try to get free information from a person who makes his living doing what we are trying to do."

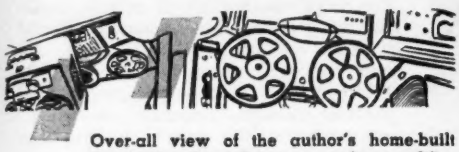
"And he's right," Mac said with a guilty grin. "Just night before last I was talking to Jimmy Palmer, the brick mason, about how I should go about building an outdoor oven for our patio next spring. He promptly got out some miniature bricks that bricklayers use to work out their problems and showed me exactly how to go about it."

"While we're confessing, I may as well, too," Barney said. "Carl Farmer, the garage mechanic, brought his set

(*Continued on page* 135)

A Professional Tape Recording Amplifier for Home Hi-Fi Systems

By
MAURICE P. JOHNSON
Facilities Engr., Station WAAM



Over-all view of the author's home-built "professional-type" tape recorder amplifier designed to improve home music systems.

The design and construction of a versatile recording and playback amplifier for use with inexpensive tape decks to produce quality tapes at low cost. Audio mixer is provided.

IN A SHORT period of years, tape recorders have come to play an increasingly important role in the home audio system. A few years back, tape recorders were found only in recording studios, broadcast stations, and other professional establishments. Today, by contrast, there are recorders available in all price ranges, with the result that they are being used at all levels of audio system complexity, including the home music system.

There is little need to emphasize the convenience of recording as offered by the tape recorder in conjunction with the home audio outfit. The advantages of recording broadcasts, such as those aired by fine-music FM stations, for future use are obvious. The sentimental aspects of recording the voices of children, friends, or others need not be expounded. In short, it is apparent that a tape recorder is a valuable adjunct to any home sound system.

It is, of course, possible to buy commercial recorders in many price ranges and of varying degrees of excellence. However, there are many audio fans who enjoy constructing their own high-fidelity systems. From such a constructor's point of view, there are two general assemblies in the tape recorder. The tape transport mechanism is a mechanical device requiring close tolerances and careful fits, as well as ingenious design. As such, it is not easily duplicated by the home constructor. Fortunately, tape transport mechanisms of good quality are readily available so that the job of assembling a custom tape recorder can be confined to the construction of a suitable amplifier. Such an amplifier will be discussed in this article. While the unit described is capable of providing high-fidelity performance, emphasis has been directed toward a design involving a relatively small cash outlay.

The design of the amplifier is predicated, to a large degree, by the recording heads and transport mechanism involved. An inexpensive *Pentron* 9T-3M mechanism was selected as typical of the commercially available tape transports. Naturally, one of the others might have been equally satisfactory.

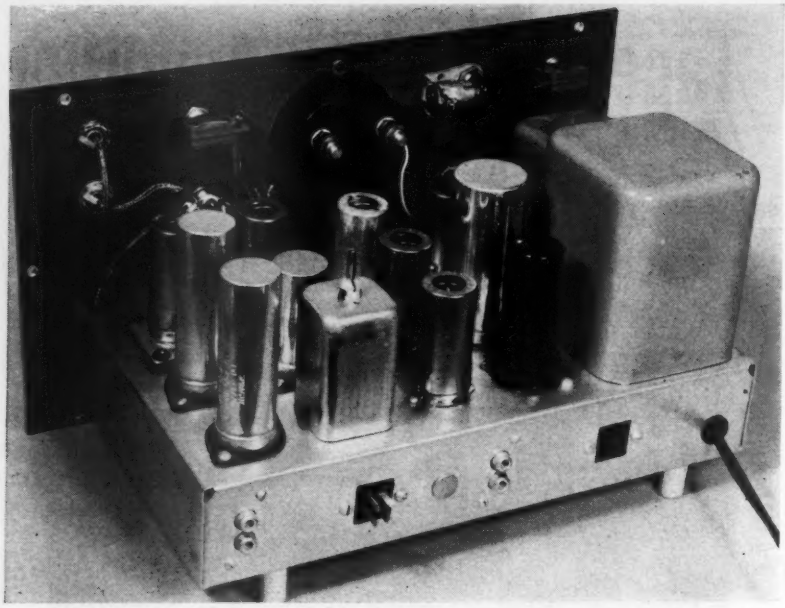
Specifications on the 9T-3M include 3.75 and 7.5 inches-per-second tape speeds, and a flutter of 0.3% at 7.5 ips. Speed stability, wow, and flutter determine the mechanical limits of tape fidelity, with values below 0.5% considered necessary for quality results. The inexpensive mechanism compares favorably with more expensive units in this respect. One professional broadcast tape recorder, as an example, is rated at 0.2% r.m.s. combined flutter and wow at 7.5 ips speed. Thus, it is seen that the mechanical abilities of the inexpensive transport need not be a limiting factor in the design of a high-fidelity tape outfit.

The heads furnished in production models of the 9T-3M have removable pole pieces, so that single-track or dual-track heads may be interchanged as desired. Single-track heads were used during development work on the project, so that tapes could be recorded on the 9T-3M and played on an *RCA* RT-11A broadcast recorder for quality and equalization checks.

A combined record-playback head with a gap of .0005" is used, thereby becoming the limiting factor on the frequency response. Such heads as the *Brush* "Redheads" with .00025" gaps, or *Dynamu* heads with .00015" gaps are theoretically capable of more extended high-frequency response. However, with the existing heads on the *Pentron,* and proper equalization, it should be possible to obtain reasonably flat response from 50 to over 10,000 cps, at the 7.5 ips speed. This range compares quite favorably with professional machines operating at this speed. Distortion-free response beyond 10 kc. makes the use of professional speeds of 15 or even 30 ips almost essential. Other factors such as beats and intermodulation between high audio frequencies and the supersonic erase and bias oscillator serve to complicate the design for extremely high frequency response.

In general, at 7.5 ips speed, the overall characteristic of the head without equalization is as shown on next page. At this speed, it will be noticed that peak response is obtained in the vicinity of 1 to 3 kc. Because the head is a magnetic device, lower frequencies fall off in direct proportion to frequency, the slope being independent of the tape speed. Another way of stating the same thing is to say that the response falls off at a rate of 6 db per octave.

At high frequencies, however, the roll-off is determined to a large degree by tape speed as well as the head gap. The individual head thus enters



Rear view shows 2 separate input jacks (left) and 2 paralleled output jacks (center). The Jones connectors carry signals to the tape heads and a.c. power to the tape deck.

into the design problem. Frequency response curves of magnetic heads are covered in detail in such texts as Oliver Read's "Recording and Reproduction of Sound," or "Magnetic Recording" by S. J. Begun, for those interested in a more complete analysis. It should be noted, however, that in this case the relative levels at 50 cps and at 10 kc. are approximately 20 db below the response at 2 kc. This unequalized head response indicates the nature of equalization which must be introduced in the amplifier.

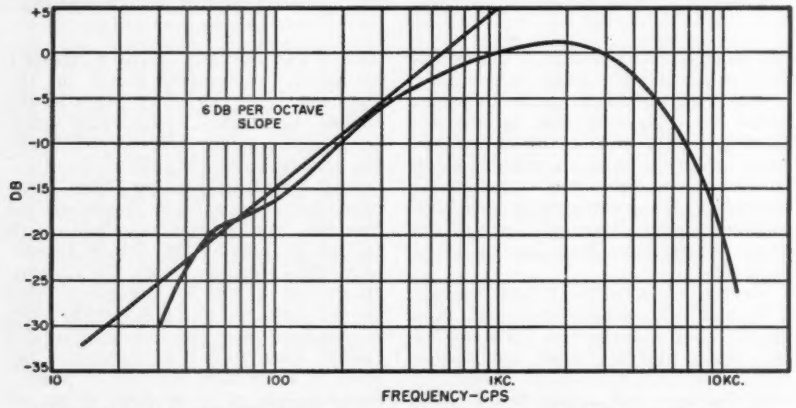
An article by W. E. Stewart in the June 1955 issue of this magazine ("Why the NARTB Curve for Magnetic Tape") discusses the NARTB recording standard. Such factors as tape overload characteristics, frequency *vs* energy content of music and voice, as well as head characteristics enter into the selection of the recording curves. In general, most satisfactory results are obtained by pre-emphasis on the highs during recording, and low-frequency boost inserted as post-emphasis at playback.

Progressing to the amplifier itself, now that the nature of the problem has been considered, it was decided that the design should be as flexible and versatile as practical, in order to cope with almost any recording situation which might arise. To this end, the amplifier was designed for three definite purposes: namely, a record amplifier, a playback amplifier, with the third application of mixer amplifier for public address work included without adding complexity to the circuit. Several stages have been made multi-purpose by incorporating a five-section transfer "function" switch.

Discussing the playback amplifier first, it is necessary to provide a high gain circuit, with low noise and hum levels to amplify the feeble tape signals to levels sufficient to feed into the usual home high-fidelity audio system. Bass boost must be included, with a turnover at 1000 cps, and a maximum boost of 20 db at 50 cps. Examination of the circuit will reveal four stages devoted to this function.

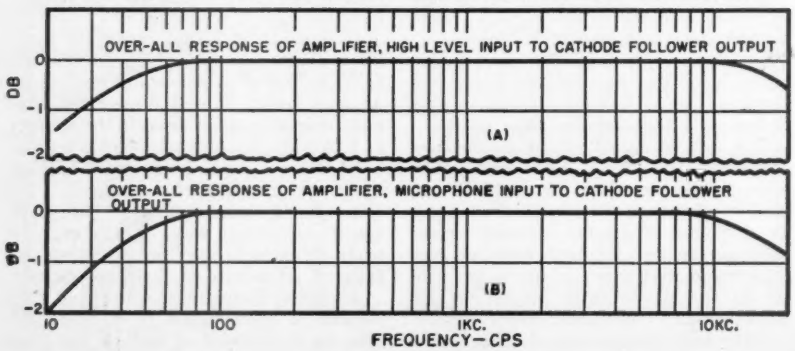
The record-playback head is connected to a low-noise pentode preamplifier stage, with function switch S_{1A} in the "Play" position. This 5879 stage is designed for maximum gain, in the interests of a high signal-to-noise ratio. The preamplifier stage is coupled to the playback gain control, R_8. Section S_{1C} of the function switch inserts the bass boost equalizer, consisting of C_4 and R_8 shunted across the preamp plate load. The equalized signal is further amplified by a triode mixer stage, then applied to the following 12AX7 output tube. One triode is used for additional voltage gain, while the remaining half of the dual triode serves as a cathode follower to furnish a low impedance output at a signal level of over one volt.

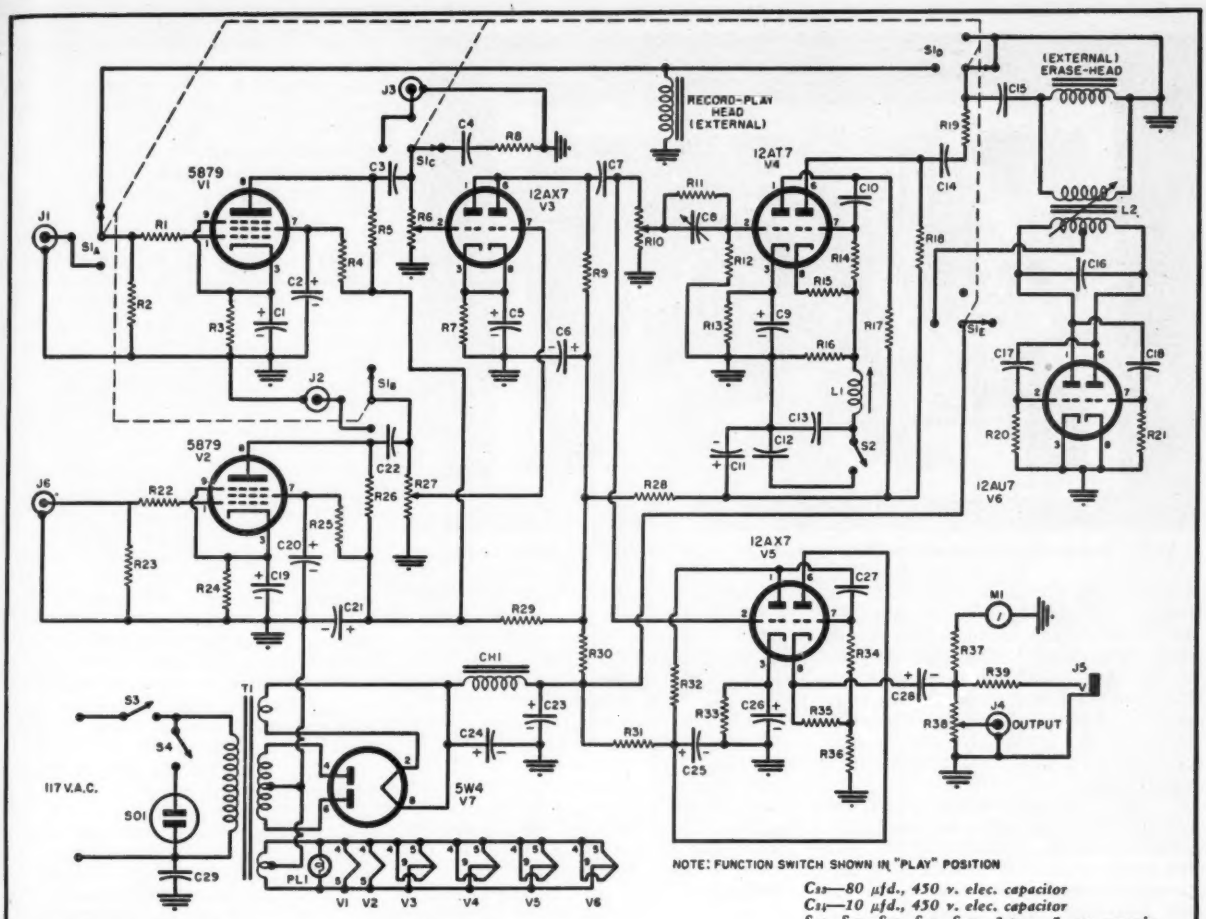
It should be noted that the only frequency compensation in this entire chain is that produced by the shunt equalizer, C_4 and R_8. In fact, with the equalizer removed, the response of the playback amplifier is flat within ±1 db from 20 to 20,000 cps. Such convenient methods of equalization have the advantages of easy adjustment or modification to conform to the needs of a particular head. For example, the values of the shunt equalization components given are correct only for the .0005" gap recording head. If it is desired to use a head with a .00025" gap, the value of C_4 should be reduced to .01 or .02 μfd. If a head with a gap of .00015" is employed, C_4 should be further reduced to .005 or .008 μfd. Additional data on this equalization



Recording head characteristics shown at 7.5 ips tape speed with no equalization provided. This curve is based on data supplied by the Pentron Corporation and is taken with the Pentron 9T-3M head and the 3-M Company's "Scotch" #111-A tape.

Over-all response of the tape recorder amplifier at two different input levels.





R_1, R_{28}—33,000 ohm, ½ w. res
R_2, R_{23}—2 megohm, ½ w. res.
R_3, R_{24}—2700 ohm, ½ w. res.
R_4, R_{25}—2.2 megohm, 1 w. res.
R_5, R_{26}—470,000 ohm, 1 w. res.
R_6, R_{10}, R_{27}—250,000 ohm audio pot
R_7, R_{13}, R_{37}—1500 ohm, ½ w. res.
R_8—10,000 ohm, ½ w. res.
R_9, R_{22}—47,000 ohm, 1 w. res.
R_{11}—680,000 ohm, ½ w. res.
R_{12}—10 megohm, ½ w. res.
R_{14}—470,000 ohm, ½ w. res.
R_{15}—470 ohm, ½ w. res.
R_{16}—8200 to 47,000 ohm, ½ w. res. (see text)
R_{17}—100,000 ohm, 1 w. res.
R_{18}—39,000 ohm, 1 w. res.
R_{19}—68,000 ohm, ½ w. res.
R_{20}, R_{31}, R_{29}—100,000 ohm, ½ w. res.
R_{30}—2700 ohm, 1 w. res.
R_{29}—10,000 ohm, 1 w. res.
R_{30}, R_{31}—4700 ohm, 1 w. res.
R_{32}—3300 ohm, ½ w. res.
R_{34}—1 megohm, ½ w. res.
R_{35}—820 ohm, ½ w. res.
R_{36}—47,000 ohm, ½ w. res.
R_{38}—1 megohm audio pot
C_1-C_9-C_{19}—20/20/20 µfd., 25 v. elec. capacitor
C_2-C_{20}—10/10 µfd., 350 v. elec. capacitor
C_3, C_7, C_{22}—.1 µfd., 400 v. capacitor
C_4, C_{12}—.03 µfd., 400 v. capacitor
C_5, C_{26}, C_{28}—10 µfd., 25 v. elec. capacitor
C_6-C_{11}-C_{21}-C_{25}—10/10/10/10 µfd., 450 v. elec. capacitor
C_8—100-400 µµfd. trimmer capacitor
C_{10}, C_{27}, C_{29}—.05 µfd., 400 v. capacitor
C_{13}—.01 µfd., 400 v. capacitor
C_{14}—.25 µfd., 400 v. capacitor
C_{15}—250 µµfd., ceramic capacitor
C_{16}—.004 µfd., 600 v. capacitor
C_{17}, C_{18}—500 µµfd. ceramic capacitor
C_{23}—80 µfd., 450 v. elec. capacitor
C_{24}—10 µfd., 450 v. elec. capacitor
S_{1A}, S_{1B}, S_{1C}, S_{1D}, S_{1E}—3-pos., 5-sec. ceramic function switch (Centralab PA-2015)
S_2, S_3, S_4—S.p.s.t. bat-handle toggle switch
M_1—Rectifier type db or vu meter (see text)
L_1—20 mhy. variable powdered-iron-core coil (TV linearity or width coil can be used)
L_2—Osc. coil (Pentron 321-4 or equiv.)
T_1—Power trans., 350 v. @ 40 ma.; 5 v. @ 2 amps.; 6.3 v. @ 3 amps. (encased type)
J_1, J_6—Shorting type microphone connector (Amphenol Series 75)
J_2, J_3, J_4—Phono jack
J_5—Phone jack
CH_1—8 hy., 40 ma. filter choke (encased type)
SO_1—117 volt power-line socket
PL_1—6.3 volt pilot light
V_1, V_2—5879 tube
V_3, V_5—12AX7 tube
V_4—12AT7 tube
V_6—12AU7 tube
V_7—5W4 tube

Complete schematic diagram of the tape recorder amplifier. It may also be used as a two-channel audio mixer for p.a. applications.

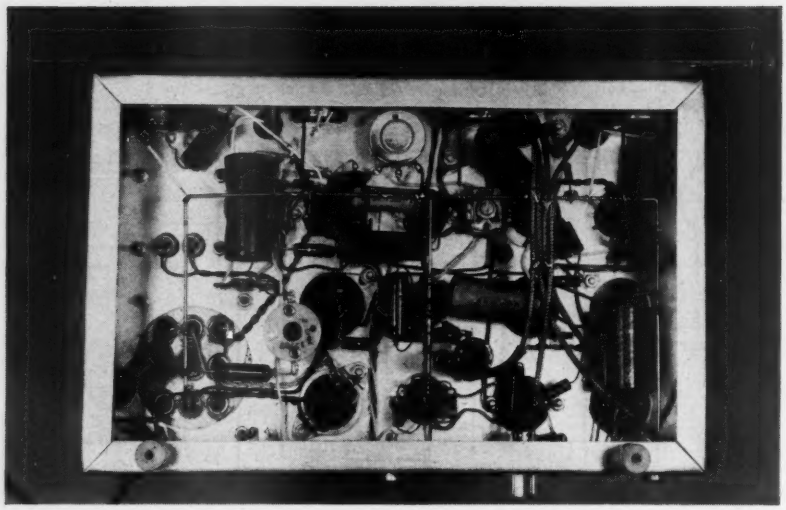
technique is available in the article, "Design Considerations for High-Quality Reproducing Systems" (Part 2), by Herb Matthews in the May 1950 issue of this magazine.

The playback amplifier is straightforward, but the record amplifier becomes a bit more complex. The first aspect to be considered concerns the input facilities to be provided. Some simple recorders provide a single mixer channel, but greater flexibility is a decided asset. Two mixer channels are obviously needed. A high-level and a low-level input for each channel allows complete mixing flexibility. Thus, two inputs are available for crystal or other high impedance microphones. Two additional inputs for high-level signals provide for FM-AM tuners, TV audio, phono signals, or other sources. With two mixer channels, independent control of each channel level is possible. It is apparent that recorded music can be introduced as "background" for a microphone pickup; cross-fades and similar professional mixing techniques are possible, to list a few of countless examples.

Referring again to the circuit, the 5879 stage now functions as one microphone preamp with S_{1A} in the "Record" position. An additional 5879 is similarly used for the second microphone preamp. Series grid resistors are added to avoid rectification of strong broadcast carriers which can occasionally prove troublesome in high-gain amplifiers. (See the short item "FM Interference" by Ken Maxwell on page 122 of the February 1951 issue of this magazine.)

The two high-level inputs are introduced through sections S_{1C} and S_{1B} of the function switch. R_6 and R_{27} serve as the mixer gain controls. These controls feed individual grids of the mixer tube, the common plate load producing electronic mixing without interaction or crosstalk. The output of the mixer is parallel-fed to two independent output amplifiers.

The 12AX7 amplifier-cathode follower circuit now functions as the



Under chassis view of amplifier. Note ground bus which is used as major tie-point.

monitor amplifier. A recording level meter and a headphone output jack are added to the cathode follower for this application. Notice that only the mixer gain controls determine the level supplied to the meter and headphones. Additionally, the normal amplifier output is available with an output gain control affecting this output signal only.

A 12AT7 is used for the record amplifier section. A screwdriver-adjusted gain control, R_{10}, determines the level fed to the recording head, and is used to coordinate the level read by the meter and that being supplied to the head. The two triodes of the 12AT7 are connected as conventional voltage amplifiers, plus the addition of high frequency pre-emphasis to produce the necessary tape equalization. The parallel combination of R_{11} and C_8 provide high frequency boost. The capacitor acts as a high-pass filter, with an inherent slope of 6 db per octave. The shunt resistor limits the loss at low frequencies. The variable capacity permits the turnover to be adjusted.

Additional high peaking is accomplished by an *LC* circuit added to the cathode of the output stage. The stage normally operates with some degeneration, because of the configuration of R_{14}, R_{15}, and R_{16}. The coil and capacitor form a series circuit in shunt with R_{16}, thus producing considerable gain at the resonant frequency.

Because high-frequency response is determined by the individual head, the high-frequency equalization is made variable in three ways. As stated, capacitor C_8 determines the turnover frequency of the high boost circuit, hence it affects the response in the vicinity of 2 to 5 kc. The inductance of the cathode coil determines the frequency of resonance. Normally, it is tuned to approximately 10 kc., but the variable iron core permits shifting this frequency as needed to control the response at the extreme high frequency end. The shunt resistor across the resonant circuit (R_{16}) controls the amplitude of the peaking. Larger values of resistance give a higher "*Q*" with consequent greater amplitude at resonance, but at the expense of increased loss in the normal gain of the stage. Likewise, smaller values of resistance will reduce the peaking, and increase the over-all stage gain. For example, with R_{16} at 8200 ohms, there will be a boost of about 8 db at 10 kc. This should suffice for very narrow gap heads. A value of 47,000 ohms will boost 10 kc. about 15 db, and will be adequate for .0005" head gaps.

It should be pointed out that the total high peaking is limited by the permissible distortion. This is based on the fact that the harmonic distortion is increased by the high-frequency boosting required for equalization as compared to that inherent in a normally flat system. One additional means of high boost, which may be included, is that of resonating the record head at the desired high frequency by connecting a suitable capacity across the head, if needed.

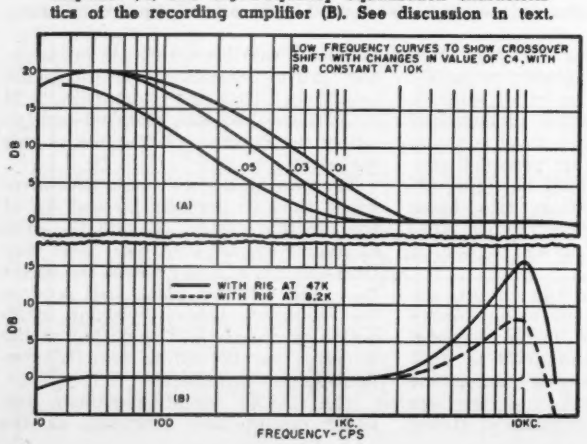
It is suggested that any individual constructor make some frequency runs on the head used and adjust the compensation networks as necessary to obtain desired flat response. Of course, the tape should be recorded with the amplifier under discussion so that the over-all equalization can be checked. With proper adjustment of these variables which determine the equalization, it should be possible to record any good microgroove record and produce playback quality which is indistinguishable from the record itself.

Quality recording should, of course, be done at the 7.5 ips speed. However, the 3.75 ips speed is available for less critical applications, such as spoken material. Switch S_2 is closed at the slow speed, to add additional capacity to the series resonant circuit, thereby lowering the frequency of resonance, to produce boost to help compensate for the increased roll-off at this speed.

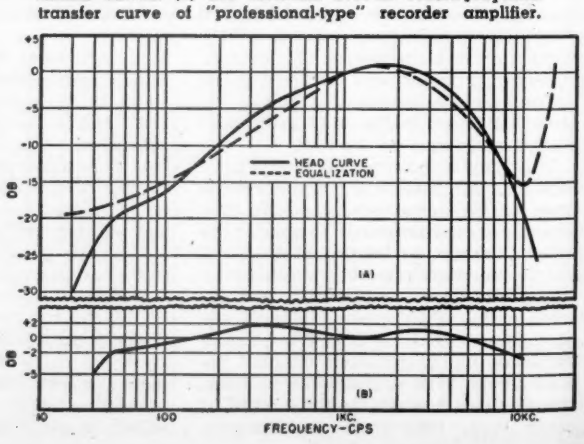
The recording output stage is coupled to the record head through the resistor R_{19}, passing through section S_{1D} of the function switch. Also necessary for tape recording, of course, is a suitable source of bias and erase voltage. This requires a supersonic oscillator which produces a symmetrical a.c. waveform. A 12AU7 standard push-pull oscillator is used for this

(*Continued on page* 163)

Low-frequency equalization characteristics of the playback amplifier (A) and high-frequency equalization characteristics of the recording amplifier (B). See discussion in text.



(A) A comparison of head characteristics and over-all equalization curves. (B) The resultant over-all record-playback transfer curve of "professional-type" recorder amplifier.



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Electronic equipment at Lockheed Missile Systems Division changes tape recording of scrambled tones into graphs from which scientists and engineers interpret a missile's flight performance. Plotter in foreground draws graphs from information on cards.

Analyzers for Missiles and Jet Pilots

Record and examine flight of guided missiles and interpret brain waves of men who pilot our jets.

COMPLETE details of a *Lockheed*-developed method of recording and analyzing a guided missile's flight was shared recently with a group of NATO aeronautical experts. The new technique processes in only two days a mass of flight information that formerly took scores of engineers and technicians weeks to analyze.

Before a missile is fired, scores of test instruments are loaded aboard. Miniaturized radio transmitters in the vehicle relay thousands of the instruments' readings, including speed, temperatures, pressures, voltages, altitude, etc., to the ground in terms of pure tones. A variation in pitch indicates a variation in reading. The tape-recorded playback is a bedlam of scrambled sound that resembles the tuning of a gigantic symphonic orchestra. Patiently unscrambling and interpreting one tone at a time took weeks in the older systems.

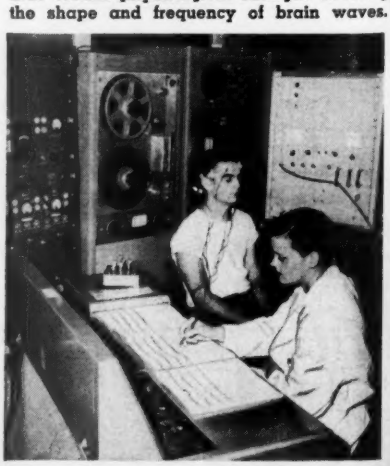
The automatic data reduction machine shown above accurately classifies as many as 100 readings per second. It then feeds the desired readings into a converter that controls a standard accounting type card-punching machine. The punched cards can be fed into a high-speed electronic computer and then into an automatic plotting machine that produces a graphic picture of the missile's performance.

The system in operation at the right was developed by Air Force and *American Machine & Foundry Co.* scientists to interpret the information presented by another instrument long used by the medical profession—the electroencephalograph. The latter is a sensitive electronic device which detects and records human brain waves.

The Air Force is now interested in the new unit for its possible use to objectively assess level of alertness in its pilots. Researchers are attempting to establish a mathematical basis for the characterization of brain waves. The instrument—called a Period Analyzer—is being developed to implement the mathematical theory.

The use of the new instrument provides techniques that appear to be more sensitive and much more rapid than present methods in distinguishing degrees of sleepiness and wakefulness in subjects. It can also correlate the brain wave pattern with deficiency of oxygen in the blood precisely. —30—

Period analyzer, a new medical research instrument developed by American Machine & Foundry Co. and Air Force scientists, measures certain physiological changes affecting the shape and frequency of brain waves.



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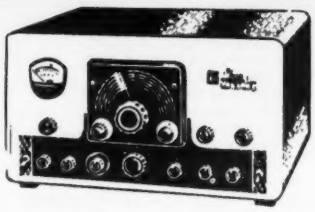

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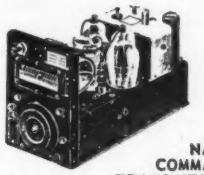

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2BN4	2.0	7	75	041-025-500-012	AB	E
3B2	2.8	0	35	515-555-050-213	J	J
5CL8-TRI	5.0	28	90	420-100-000-011	AGH	B
5CL8-TET	5.0	30	15	000-102-204-012		F
5CM8-TRI	5.0	7	15	340-103-204-013	CGH	A
5CM8-PEN	5.0	20	18	340-103-204-012		F
6BA8-TRI	6.3	7	23	042-100-423-012	ACFH	C
6BA8-PEN	6.3	7	92	042-100-423-011		I
6BK4	6.3	30	95	015-545-050-303	AE	J
6BN4	6.3	7	44	041-025-500-012	AB	E
6BR8-TRI	6.3	20	80	420-100-000-001	ACGI	B
6BR8-PEN	6.3	7	62	000-103-204-002		F
6CB5	6.3	7	62	210-455-050-300	CD	J
6CH8-TRI	6.3	40	90	032-100-042-011	ACF	I
6CH8-PEN	6.3	12	29	032-100-403-012		B
6CL8-TRI	6.3	13	90	420-100-000-001	AGH	B
6CL8-TET	6.3	11	20	000-102-204-002		F
6CM8-TRI	6.3	7	25	340-103-204-013	CGH	A
6CM8-PEN	6.3	20	20	340-103-204-012		F
6CR6-PEN	6.3	15	22	051-032-400-002	FG	E
6CR6-DIO	6.3	0	22	051-032-400-005		B
6DQ6	6.3	56	9	010-240-000-321	DH	J
12AC6	12.6	7	40	401-022-000-034	BG	E
12AD6-MIX	12.6	7	55	401-022-000-033	AFG	F
12AD6-OSC	12.6	7	80	401-022-000-033		E
12AE6-TRI	12.6	14	20	401-055-200-034	ABEF	G
12AE6-DIO-1	12.6	14	10	401-055-000-005		F
12AE6-DIO-2	12.6	14	10	401-055-000-005		E
12AF6	12.6	7	85	401-022-000-033	AG	E
12CU5	12.6	7	96	041-052-200-000	BF	G
12DQ6	12.6	56	9	010-240-000-321	DH	J
12K5	12.6	7	63	041-025-200-031	AB	G
12F8-PEN	12.6	26	90	222-102-040-033	GI	C
12F8-DIO-1	12.6	26	0	222-102-040-033		F
12F8-DIO-2	12.6	26	0	222-102-040-033		A

PHILCO MODELS 7052 & 9100

Tube Type	Fil.	R-G Bias	Fil.	Fil.	Gr.	Pl.	Sc.	C.	Su.	Press	Gm	Notes
1V6	1.1	20 10	E	X	3	1	2	0	0	P1 with P4	300	Pentode Sect.
1V6	1.1	5 35	E	X	5	6	0	0	0	P1 with P4	100	Triode Sect.
2AF4	2.5	85 36	J	R	2	3	0	5	0	P4	3200	
3A2*	3.0	83 0	J	R	0	0	0	0	0	P5	....	Cap = P. Short on 3.
3DT6	3.0	48 11	J	R	3	5	6	2	7	P4	800	
6AU4	6.3	60 0	J	X	0	5	0	3	0	P3	....	
6BA8	6.3	83 28	E	V	2	3	0	1	0	P4	2300	Triode Sect.
6BA8	6.3	87 18	E	V	7	9	8	6	0	P4	3000	Pentode Sect.
6BJ8	6.3	83 25	E	V	8	7	0	9	0	P4	2400	Triode Sect.
6BJ8	6.3	84 0	E	V	0	6	0	3	0	P1	....	Diode No. 1
6BJ8	6.3	84 0	E	V	0	1	0	2	0	P1	....	Diode No. 2
6BN8	6.3	89 8	E	V	8	7	0	9	0	P4	3700	Triode Sect.
6BN8	6.3	79 0	E	V	0	6	0	3	0	P1	....	Diode No. 1
6BN8	6.3	79 0	E	V	0	1	0	2	0	P1	....	Diode No. 2
6BR8	6.3	88 21	E	V	1	2	0	3	0	P4	3350	Triode Sect.
6BR8	6.3	80 11	E	V	9	6	7	8	0	P4	2100	Pentode Sect.
6BW4	6.3	95 0	E	V	0	7	0	9	0	P5	....	Diode No. 1
6BW4	6.3	95 0	E	V	0	1	0	9	0	P5	....	Diode No. 2
6BY8	6.3	76 11	E	V	1	7	8	9	0	P4	1840	Pentode Sect.
6BY8	6.3	78 0	E	V	0	6	0	3	0	P1	....	Diode Sect.
6CE5	6.3	87 11	J	R	3	5	6	2	0	P4	3100	
6CL5	6.3	90 68	J	R	4	0	2	3	0	P4	3200	Cap = P
6CS7	6.3	77 24	E	V	7	6	0	8	0	P4	1800	Triode No. 1
6CS7	6.3	83 32	E	V	3	1	0	9	0	P4	2400	Triode No. 2
6CU5	6.3	91 0	J	R	2	7	6	3	0	P4	6000	
6DT6	6.3	48 11	J	R	3	5	6	2	7	P4	800	
12BW4	12.6	95 0	E	V	0	7	0	9	0	P5	....	Diode No. 1
12BW4	12.6	95 0	E	V	0	1	0	9	0	P5	....	Diode No. 2
12CU5	12.6	91 0	J	R	2	7	6	3	0	P4	6000	
12K5	12.6	0 0	J	R	5	7	2	3	0	P1	225	Good—Read above Diode OK
35L6	35.0	87 21	J	R	5	3	4	7	0	P4	3680	
35W4	Blst	.. ..	J	R	0	3	6	7	0	..	....	Short on 1-2-3-4-5
35W4	35.0	65 0	J	R	0	5	0	7	0	P3	....	Rect. Sect.
35Z5	Blst	.. ..	J	R	0	5	3	7	0	..	....	Short on 1-2-3-4-5
35Z5	35.0	67 0	J	R	0	5	0	7	0	P3	....	Rect. Sect.
CK533AX	1.1	20 21	D	V	4	1	2	0	0	P1 with P4	480	

*Revised

COVER STORY

Top TV programs and many local shows now available in color all over country.

THIS is truly the year for color television. Now for the first time, families with color receivers will be able to view at least one major color program every evening in the week. NBC, which has been in the forefront on color, is broadcasting weekly a well-balanced lineup of programs including its most popular shows. CBS is also telecasting about 5½ hours of color programs per week. Among the NBC shows to be regularly colorcast each week are "The Chevy Show," "The Goodyear Playhouse," "Robert Montgomery Presents," and "The Perry Como Show." In addition, the "spectaculars" will also be in color. Such CBS star programs as "The Arthur Godfrey Show" and "The Red Skelton Show" will be regularly shown in color. Special CBS color shows are "The Ford Star Jubilee" and "Shower of Stars."

This means that all viewers within the reception area of any NBC or CBS network station which has the facilities to telecast network shows in color, can receive these programs on a color set, such as the RCA "Aldrich" model 21CS-781 ($495.00) shown on this month's cover. Over 50 per-cent of the 200 NBC network stations now broadcast network color. The number of CBS color network stations is also high.

In addition to the network shows, many stations are originating local color shows. WABD, the New York City Du Mont station, plans to telecast cartoon shows in color during the day and evening. All shows originating at WNBQ in Chicago are broadcast in color. It broadcasts approximately 25 hours of local color a week. Many other stations now have color cameras and/or color film equipment and many stations are now expanding for color.

This all means that buyers of color TV sets this winter can look forward to many pleasant hours of entertainment in full-color. —30—

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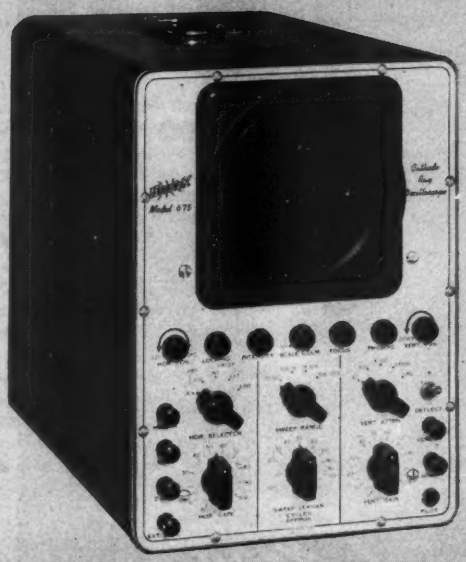

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New

MODEL O-11
Shpg. Wt. 21 Lbs.
$69.50

* An improved model of what was already an outstanding instrument.
* Performance is unmatched in this price range.
* Incorporates the extra features required for color TV servicing.

Extra!
A FULL YEAR TO PAY
SEND FOR DETAILS OF HEATH TIME-PAYMENT PLAN.

5 BIG REASONS WHY

Heathkits®
ARE YOUR BEST BUY...

HEATH COMPANY
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICH.

HEATHKIT ETCHED CIRCUIT, PUSH-PULL

5" Oscilloscope Kit

COLOR TV

The previous Heathkit oscilloscope (Model O-10) which was already a most remarkable instrument, has been improved even further with the release of the Heathkit Model O-11. It incorporates all the outstanding features of the preceding model, *plus* improved vertical linearity, better sync stability, especially at low frequencies, and much-improved over-all stability of operation, including less vertical bounce with changes in level. These improvements in the Model O-11 circuit make it even more ideally suited for color TV servicing, and for critical observations in the electronic laboratory. Vertical response extends from 2 CPS to 5 MC without extra switching. Response only down 1½ DB at 3.58 MC. The 11-tube circuit features a 5UP1 cathode-ray tube. Sync circuit functions effectively from 20 CPS to better than 500 kc in five steps. Modern etched circuit boards employed in the oscilloscope circuit cut assembly time almost in half, permit a level of circuit stability never before achieved in an oscilloscope of this type, and insure against errors in assembly. Both vertical and horizontal output amplifiers are push-pull. Built-in peak-to-peak calibrating source – step-attenuated input – plastic molded capacitors and top-quality parts throughout – pre-formed and cabled wiring harness – and numerous other "extra" features. A professional instrument for the serviceshop or laboratory. Compare its specifications with those of scopes selling in much higher price brackets. You can't beat it!

1 **FEWER DOLLARS BRING MORE REAL QUALITY.**
- Factory-to-you sales eliminate extra profit margin.
- "Build-it-yourself" eliminates labor charge.
- Heath purchasing power cuts component costs.

2 **PERSONAL SERVICE ASSURES CUSTOMER SATISFACTION.**
- You deal directly with the manufacturer.
- We are interested in you before and after sale.

3 **PROVEN DESIGNS MEAN RELIABLE PERFORMANCE.**
- Research and development efforts concentrated on kits only.
- All kits guaranteed to meet advertised specifications.

4 **EVERY KIT BACKED BY WORLD-WIDE REPUTATION.**
- The world's largest manufacturer of electronic equipment in kit form.
- Producer of more than a million electronic kits for the home workshop and industry.

5 **EASY TIME-PAYMENT PLAN TO FIT YOUR BUDGET.**

GREATEST SELECTION . . .

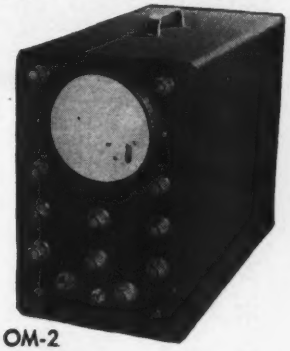
Whether your particular special interest is in servicing, ham-radio, high-fidelity, or just experimenting—there are Heathkits to fill your needs. You can equip an entire service shop or lab, buy a complete ham station or high-fidelity system, or set up a really deluxe home workshop, by choosing from the more than 70 different "do-it-yourself" electronic kits by Heath. Just glance through the kits displayed in this ad, and you will get some idea of the tremendous array of low-priced, high-quality electronic equipment available.

New **HEATHKIT ETCHED CIRCUIT**

5" Oscilloscope Kit

- *Brand new model with improved performance specifications.*
- *Full 5" scope for service work at a remarkably low price.*
- *Attractively styled front panel in charcoal gray with sharp white lettering.*
- *Easy to build from step-by-step instructions and large pictorials. Not necessary to read schematic.*

This new and improved oscilloscope retains all the outstanding features of the preceding model, but provides wider vertical frequency response, extended sweep-generator coverage, and increased stability. A new tube complement and improvements in the circuit make these new features possible. Vertical frequency response is essentially flat to over 1 mc, and down only 1½ DB at 500 kc. The sweep generator multivibrator functions reliably from 30 to 200,000 CPS, almost twice the coverage provided by the previous model. Deflection amplifiers are push-pull, and modern etched circuits are employed in critical parts of the design. A 5BP1 cathode-ray tube is used. The scope features external or internal sweep and sync, one volt peak-to-peak reference voltage, 3-position step-attenuated input, adjustable spot-shape control, and many other "extras" not expected at this price level. A calibrated grid screen is also provided for the face of the CRT, allowing more precise observation of wave shapes displayed. The new Model OM-2 is designed for general application wherever a reliable instrument with good response characteristics may be required. Complete step-by-step instructions and large pictorial diagrams assure easy assembly.



MODEL OM-2

$42.50

Shpg. Wt. 21 Lbs.

HEATHKIT LOW CAPACITY PROBE KIT

Oscilloscope investigation of high frequency, high impedance, or broad bandwidth circuits encountered in television requires the use of a low-capacity probe to prevent loss of gain, circuit loading, or waveform distortion. The Heathkit low-capacity probe may be used with your oscilloscope to eliminate these effects. It features a variable capacitor, to provide correct instrument impedance match. Also, the ratio of attenuation can be varied.

No. 342

$3.50

Shpg. Wt. 1 Lb.

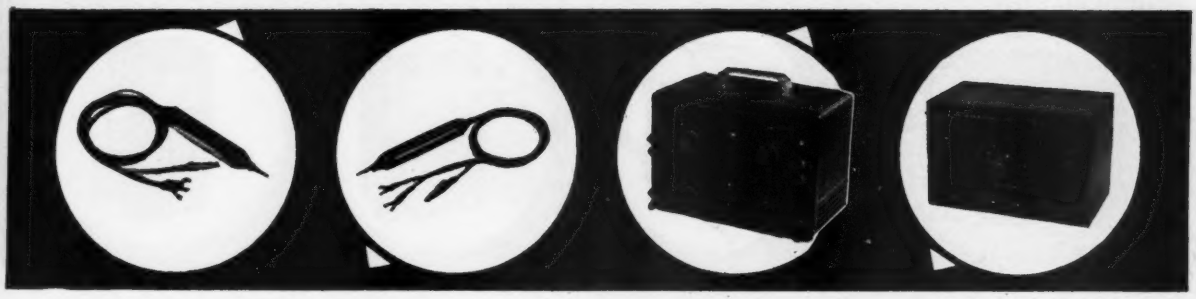
HEATHKIT ELECTRONIC SWITCH KIT

This handy device allows simultaneous oscilloscope observation of two signals by producing both signals, alternately, at its output. It features an all-electronic switching circuit, with no moving parts. Four switching rates are selected by a panel switch. Provides actual gain for input signals, and has a frequency response of ± 1 DB from 0 to 100 kc. Sync output provided to control and stabilize scope sweep. Will function at signal levels as low as 0.1 volt. This modern device finds many applications in the laboratory and service shop. It employs an entirely new circuit, and yet is priced lower than its predecessor.

MODEL S-3

$21.95

Shpg. Wt. 8 Lbs.



HEATHKIT SCOPE DEMODULATOR PROBE KIT

Extend the usefulness of your oscilloscope by employing this probe. Makes it possible to observe modulation of RF or IF carriers found in TV and radio receivers. Functions much like an AM detector to pass only modulation of signal, and not the signal itself. Among other uses, it will be helpful in alignment work, as a signal tracer, and for determining relative gain. Applied voltage limits are 30 volts (RMS) and 500 volts DC. It uses an etched circuit board to simplify assembly.

NO. 337-C

$3.50

Shpg. Wt. 1 Lb.

HEATHKIT VOLTAGE CALIBRATOR KIT

This entirely new voltage calibrator produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors assure accurate output amplitude, and multivibrator circuit guarantees good, sharp square waves, as distinguished from clipped sine waves. Output frequency is approximately 1000 CPS. Fixed outputs selected by panel switch are; .03, 0.1, 0.3, 1.0, 3.0, 10, 30, and 100 volts peak-to-peak. Allows measurement of unknown signal amplitudes by comparing to known peak-to-peak output of VC-3 on an oscilloscope. Will also double as a square wave generator at 1000 cycles for determining gain, frequency response, or phase-shift characteristics of audio amplifiers. Equally valuable in the laboratory or in radio and TV service shops.

MODEL VC-3

$12.50

Shpg. Wt. 4 Lbs.

HEATHKIT ETCHED CIRCUIT VACUUM TUBE

$24.50

Shpg. Wt. 7 Lbs.

Voltmeter Kit

The fact that this instrument is the world's largest-selling VTVM says a great deal about its accuracy, reliability, and overall quality. The V-7A is equally popular in the laboratory or service shop, and represents an unbelievable test equipment bargain, without a corresponding sacrifice in quality. Its appearance reflects the performance of which it is capable. A large 4½" panel meter is used for indication, with clear, sharp calibrations for all ranges. Front panel controls consist of a rotary function switch and a rotary range selector switch, zero-adjust, and ohms-adjust controls. Precision 1% resistors are used in the voltage divider circuits and etched circuits are employed for most of the circuitry. This makes the kit much easier to build, eliminates the possibility of wiring errors, and assures duplication of laboratory instrument performance. This multi-function VTVM will measure AC voltage (rms), AC voltage (peak-to-peak), DC voltage, and resistance. There are 7 AC (rms) and DC voltage ranges of 0-1.5, 5, 15, 50, 150, 500, and 1500. In addition, there are 7 peak-to-peak AC ranges of 0-4, 14, 40, 140, 400, 1400, and 4000. 7 ohmmeter ranges provide multiplying factors of X1, X10, X100, X1000, X10K, X100K, and X1 megohm. Center-scale resistance readings are 10, 100, 1000, 10K, 100K ohms, 1 megohm, and 10 megohms. A DB scale is also provided. The precision and quality of the components used in this VTVM cannot be duplicated at this price through any other source. Model V-7A is the kind of instrument you will be proud to own and use.

- *Easy to build — a pleasure to use.*
- *1% precision resistors employed for high accuracy.*
- *Etched circuit board cuts assembly time in half.*

HEATHKIT Etched Circuit RF PROBE KIT

This RF probe extends the frequency response of any 11-megohm VTVM so that it will measure RF up to 250 megacycles within ± 10%. Employs printed circuits for increased stability and ease of assembly. Ideal for extending service and laboratory applications of your Heathkit VTVM.

No. 309-C

$3.50

Shpg. Wt. 1 Lb.

HEATHKIT SCOPE DEMODULATOR PROBE KIT

This probe functions like an AM detector to pass only modulation of signal and not signal itself. Permits observation of modulation from RF or IF carriers in TV and radio receivers. Extends usefulness of your oscilloscope. Voltage limits are 30 V. rms, and 500 V. DC. Very valuable in service or laboratory applications.

No. 337-C

$3.50

Shpg. Wt. 1 Lb.

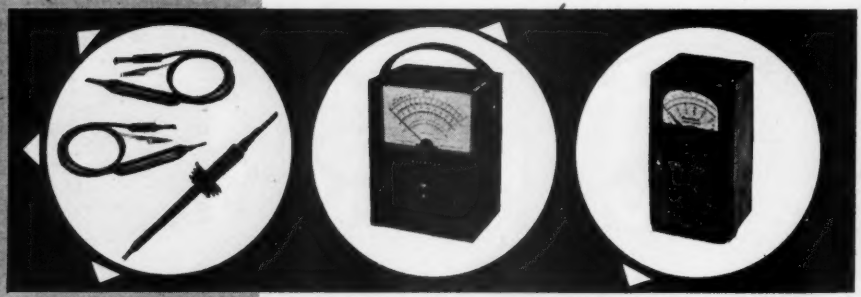
HEATHKIT 20,000 OHMS/VOLT VOM KIT

Sensitivity of this instrument is 20,000 ohms-per-volt DC and 5,000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500, and 5000 volts for both AC and DC. Also measures current in the ranges of 0-150 microamperes, 15 ma, 150 ma, 500 ma, and 15 a. Resistance ranges provide multipliers of X1, X100, and X10,000, resulting in center scale readings of 15, 15,000, and 150,000 ohms. DB ranges cover from —10 db to +65 db. Housed in attractive black bakelite case with plastic carrying handle, this fine instrument provides a total of 25 meter ranges on its two-color scale. It employs a sensitive 50 microampere, 4½" meter and features all 1% precision multiplier resistors. Requires no external power, and is, therefore, valuable in portable applications where no AC power is available.

MODEL MM-1

$29.50

Shpg. Wt. 6 Lbs.



HEATHKIT 30,000 VOLT DC HIGH VOLTAGE PROBE KIT

This probe provides a multiplication factor of 100 on the DC ranges of the Heathkit 11-megohm VTVM. Precision multiplier resistor mounted inside the two-color plastic probe body. Plenty of insulation for completely safe operation, even at highest TV potentials. Designed especially for TV service work.

No. 336

$4.50

Shpg. Wt. 2 Lbs.

HEATHKIT HANDITESTER KIT

The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Direct current ranges are 0-10 ma, and 0-100 ma. Ohmmeter ranges are 0-3000 (30 ohm center scale) and 0-300,000 ohms (3,000 ohms center scale). Uses a 400 microampere meter for sensitivity of 1000 ohms-per-volt. A very popular test device for the home experimeter, electricians, and appliance repairmen, and for use as an "extra" instrument in the service shop. Its small size and rugged construction make it perfect for any portable application. Easily slips into your tool box, glove compartment, coat pocket, or desk drawer. Top quality, precision components employed throughout.

MODEL M-1

$14.50

Shpg. Wt. 3 Lbs.

HEATH COMPANY

A Subsidiary of Daystrom, Inc.

BENTON HARBOR 15, MICH.

CONTROLLED QUALITY . . .

Incoming parts inspection, and inspection of material coming off of our own production line assures you of the finest "build-it-yourself" kit that money can buy. Each kit contains all the components you need for assembly—and you can have confidence in the quality of the parts themselves. In addition to this inspection procedure, an extensive proof-building program for each new kit guarantees easy-to-follow instructions and reliable performance.

HEATHKIT NEW AUDIO VACUUM TUBE

Voltmeter Kit

- ✻ *Brand new circuit for extended frequency response and added stability.*
- ✻ *Ten accurate ranges from 0-.01 to 0-300 volts.*
- ✻ *Modern, functional panel styling. "On-off" switch at both extreme ends of range switch.*

This brand new AC vacuum tube voltmeter emphasizes stability, broad frequency response, and sensitivity. It is designed especially for audio measurements, and low-level AC measurements in power supply filters, etc. Employs a cascode amplifier circuit with cathode-follower isolation between the input and the amplifier, and between the output stage and the preceeding stages. An extremely stable circuit with high input impedance (1 megohm at 1000 CPS). Response of the AV-3 is essentially flat from 10 CPS to 200 kc, and is usable for tests even beyond these frequency limits. Increased damping in the meter circuit stabilizes the meter for low frequency tests. Nylon insulating bushings at the input terminals reduce leakage, and permit the use of the 5-way Heath binding post.

The extremely wide voltage range covered by the AV-3 makes it especially valuable not only in high-fidelity and service work, but also in experimental laboratories. AC (RMS) voltage ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 V. Decibel ranges cover −52 DB to +52 DB. An entirely new circuit as compared to the previous model. Employs 1% precision multiplier resistors for maximum accuracy. Handles AC measurements from a low value of one millivolt to a maximum of 300 volts.

MODEL AV-3

$29.95

Shpg. Wt. 5 Lbs.

HEATHKIT AUDIO WATTMETER KIT

This instrument measures audio power directly at 4, 8, 16, or 600 ohms. Load resistors are built in. Covers 0-5 MW, 50 MW, 500 MW, 5 W, and 50 W full scale. Provides 5 switch-selected DB ranges covering from −10 DB to +30 DB. Large 4½" 200 microampere meter and precision multiplier resistors insure accuracy. Frequency response is ± 1 DB from 10 CPS to 250 kc. Functions from AC power line. Use in the audio laboratory or in home workshop.

MODEL AW-1

$29.50

Shpg. Wt. 6 Lbs.

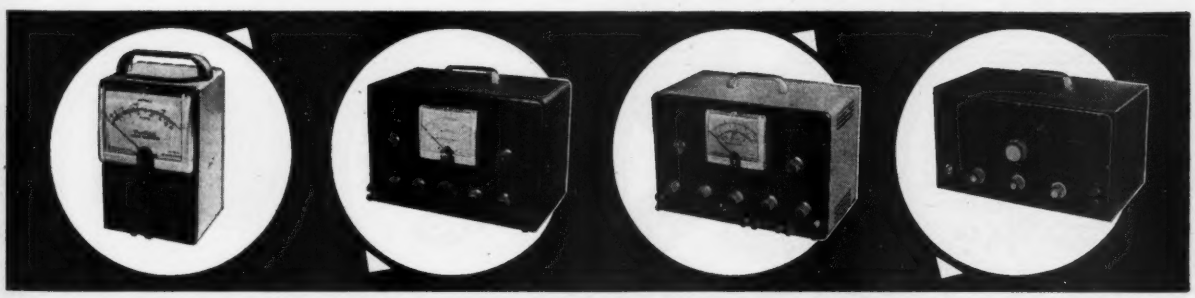
HEATHKIT AUDIO ANALYZER KIT

This multi-function instrument combines an AC VTVM, an audio wattmeter, and an intermodulation analyzer into one case, with combined input and output terminals and built-in high and low frequency oscillators. The VTVM ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts (RMS). Wattmeter ranges are .15 MW, 1.5 MW, 15 MW, 150 MW, 1.5 W, 15 W, 150 W. IM scales are 1%, 3%, 10%, 30%, and 100%. Provides internal load resistors of 4, 8, 16, or 600 ohms. A valuable instrument for the engineer or serious audiophile.

MODEL AA-1

$49.95

Shpg. Wt. 13 Lbs.



HEATHKIT HARMONIC DISTORTION METER KIT

The HD-1 is equally valuable for the audio engineer or the serious audiophile. Used with a low-distortion audio signal generator, this instrument will measure the harmonic content of various amplifiers under a variety of conditions. Functions between 20 and 20,000 CPS, and reads distortion directly on the panel meter in ranges of 0-1, 3, 10, 30, and 100 percent full scale. Built-in VTVM for initial reference settings and final distortion readings has voltage ranges of 0-1, 3, 10, and 30 volts. 1% precision resistors employed for maximum accuracy. Features voltage regulation and other "extras". Meter calibrated in volts (RMS), per-cent distortion, and DB.

MODEL HD-1

$49.50

Shpg. Wt. 13 Lbs.

HEATHKIT AUDIO OSCILLATOR KIT

Producing both sine waves and square waves, the Model AO-1 covers a frequency range of 20 to 20,000 CPS in three ranges. An extra feature is thermistor regulation of output for flat response through the entire frequency range. AF output is provided at low impedance, and with low distortion. Produces good sine waves, and good, clean square waves with a rise time of only two micro-seconds for checking square wave response of audio amplifiers, etc. Designed especially for the serviceman and high-fidelity enthusiast. A real dollar value in test equipment.

MODEL AO-1

$24.50

Shpg. Wt. 10 Lbs.

HEATHKIT

MODEL AG-9

$34.50

Shpg. Wt. 8 Lbs.

- *Less than 0.1% distortion — ideal for hi fi work.*
- *Large 4½" meter indicates output.*
- *Step-type tuning for maximum convenience.*

Audio Generator Kit

This particular audio generator is "made to order" for high fidelity applications. It provides quick and accurate selection of low-distortion signals throughout the audio range. Three rotary selector switches on the front panel allow selection of two significant figures and a multiplier for determining audio frequency. In addition, it incorporates a step-type output attenuator and a continuously variable attenuator. Output is indicated on a large 4½" panel meter calibrated in volts and in db. Attenuator system operates in steps of 10 db, corresponding with the meter calibration. Output ranges are 0-.003, .01, .03, .1, .3, 1, 3, and 10 volts rms. A "load" switch provides for the use of a built-in 600 ohm load or an external load of higher impedance when required. Output and frequency indicators accurate to within ± 5%. Distortion is less than .1 of 1% between 20 cps and 20,000 cps. Total range is 10 cps to 100 kc. New engineering details combine to provide the user with an unusually high degree of operating efficiency. Oscillator frequency selected entirely by the switch method means that accurate resetability is provided. Comparable to units costing many dollars more, and ideal for use in critical high fidelity applications. Shop and compare, and you will appreciate the genuine value of this professional instrument.

HEATHKIT RESISTANCE SUBSTITUTION BOX KIT

The RS-1 contains 36 10% 1-watt resistors ranging from 15 ohms to 10 megohms in standard RETMA values. All values are switch-selected for use in determining desirable resistance values in experimental circuits. Many applications in radio and TV service work.

MODEL RS-1

$5.50

Shpg. Wt. 2 Lbs.

HEATHKIT CONDENSER SUBSTITUTION BOX KIT

This kit contains 18 RETMA standard condenser values that can be selected by a rotary switch. Values range from 0.00001 mfd to 0.22 mfd. All capacitors rated at 400 volts or higher. Capacitors are either silver-mica, or plastic molded.

MODEL CS-1

$5.50

Shpg. Wt. 2 Lbs.

HEATHKIT AUDIO GENERATOR KIT

The Model AG-8 is a low cost, high performance unit for use in service shop, or home workshop. It covers the frequency range of 20 cps to 1 mc in five ranges. Output is 600 ohms, and overall distortion will be less than .4 of 1% from 100 cps through the audible range. Output is available up to 10 volts, under no load conditions, and output remains constant within ±1 db from 20 cps to 400 kc. A five-step attenuator provides control of the output. Precision resistors are employed in the frequency determining network.

MODEL AG-8

$29.50

Shpg. Wt. 11 Lbs.

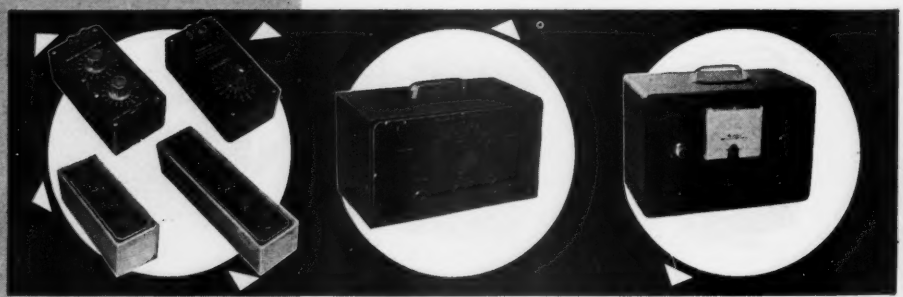
HEATHKIT DECADE CONDENSER KIT

Precision, 1% silver-mica capacitors are employed in the Model DC-1 in such a way that a selection of precision capacitor values is provided ranging from 100 mmf (.0001 mfd) to 0.11 mfd (110,000 mmf) in 100 mmf steps. Extremely valuable in all types of design and development work. Switches are ceramic wafer types.

MODEL DC-1

$16.50

Shpg. Wt. 3 Lbs.



HEATHKIT DECADE RESISTANCE KIT

The Model DR-1 incorporates twenty 1% precision resistors arranged around five rugged switches so that various combinations of switch positions will provide a total range of 1 ohm to 99,999 ohms in 1-ohm steps. Switches are labeled "units," "tens," "hundreds," "thousands," and "ten thousands." Use it for ohm-meter calibration in bridge circuits as test values in multiplier circuits, etc.

MODEL DR-1

$19.50

Shpg. Wt. 4 Lbs.

HEATHKIT VARIABLE VOLTAGE REGULATED POWER SUPPLY KIT

This power supply is regulated for stability, and the amount of DC output available from the power supply can be controlled manually from zero to 500 volts. Will provide regulated output at 450 volts up to 10 ma, or up to 130 ma at 200 volts output. In addition to furnishing B-plus, the power supply provides 6 volts AC at 4 amperes for filaments. Both the B-plus output and the filament output are isolated from ground. Ideal power supply for use in experimental work in the laboratory, the home workshop, or the ham shack. Large 4½" panel meter indicates output voltage or current.

MODEL PS-3

$35.50

Shpg. Wt. 17 Lbs.

HEATH COMPANY

A Subsidiary of Daystrom, Inc.

BENTON HARBOR 15, MICH.

BONUS PERFORMANCE . . .

If a single word had to be selected to describe Heath Company advertising policy, it would be "conservative." By this we mean that the performance specifications and features are not exaggerated, and that the descriptions are accurate. We specify performance on the conservative side so you can be sure of equaling or exceeding our specifications. In almost every instance our kits will do more than we claim. Extra care in construction, and calibration against an accurate standard can extend performance well beyond advertised levels.

HEATHKIT

Signal Generator Kit

- *No calibration required with pre-aligned coils.*
- *Modulated or unmodulated RF output.*
- *110 mc to 220 mc frequency coverage.*

MODEL SG-8

$19.50 *Shpg. Wt. 8 Lbs.*

Here is an RF signal generator for alignment applications in the service shop or the home workshop. Thousands of these units are in use in service shops all over the country. Produces RF signals from 160 kc to 110 mc on fundamentals on five bands. Also covers from 110 mc to 220 mc on calibrated harmonics. RF output is in excess of 100,000 microvolts at low impedance. Output is controllable with a step-type and a continuously variable attenuator. Front panel controls provide selection of either unmodulated RF output or RF modulated at 400 cps. In addition, two to three volts of audio at approximately 400 cps are available at the output terminals for testing AF circuits. Employs a 12AU7 and a 6C4 tube. Built-in power supply uses a selenium rectifier.

One of the most outstanding features about the Model SG-8 is the fact that it can be built in just a few hours, even by one not thoroughly experienced in electronics work. Complete step-by-step instructions combined with large pictorial diagrams assure successful assembly. Pre-aligned coils make calibration from an external source unnecessary.

HEATHKIT LABORATORY GENERATOR KIT

This laboratory RF signal generator covers from 100 kc to 30 mc on fundamentals in five bands. The output signal may be pure RF, or may be modulated at 400 cycles from 0 to 50%. Provision for external modulation has been made. RF output available up to 100,000 microvolts. Output controlled by a fixed step and a variable attenuator. Output impedance is 50 ohms. Panel meter reads RF output or percentage of modulation. Incorporates voltage regulated B+ supply, double shielding of oscillator circuits, copper plated chassis, and other "extras."

MODEL LG-1

$48.95

Shpg. Wt. 16 Lbs.

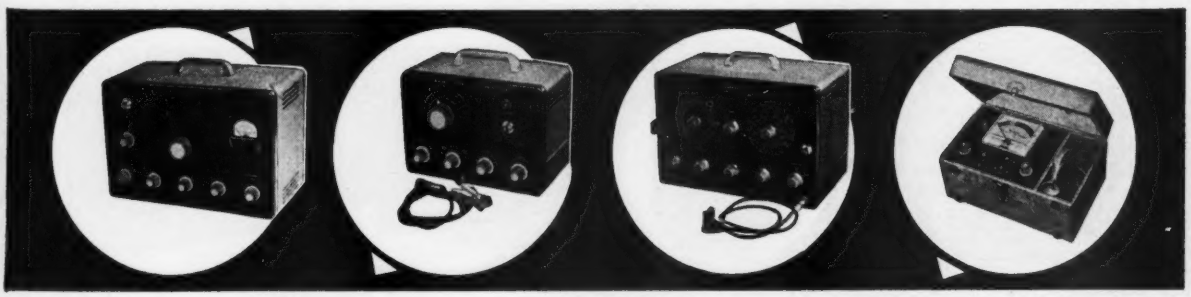
HEATHKIT TV ALIGNMENT GENERATOR KIT

This improved sweep generator model provides essential stability and flexibility for work on FM, monochrome TV, or color TV sets. Covers 3.6 mc to 220 mc in four bands. Provides usable output even on harmonics. Sweep deviation from 0-42 mc, depending on base frequency. All-electronic sweep circuit eliminates unwieldy mechanical arrangements. Includes built-in crystal marker generator providing output at 4.5 mc and multiples thereof, and variable marker covering 19 to 60 mc on fundamentals and from 57 to 180 mc on harmonics. Effective two-way blanking.

MODEL TS-4A

$49.50

Shpg. Wt. 16 Lbs.



HEATHKIT LINEARITY PATTERN GENERATOR KIT

This instrument supplies information for white dots, cross-hatch pattern, horizontal bar pattern, or vertical bar pattern. It feeds video and sync signals to the set under test, with completely controlled gain, and unusual stability. Covering channels 2 to 13, the LP-2 will produce 5 to 6 vertical bars and 4 to 5 horizontal bars. The dot pattern presentation is a *must* for the setting of color convergence controls in the color TV set. Panel provision made for external sync if desired. Use for adjustment of vertical and horizontal linearity, picture size, aspect ratio, and focus. Power supply is regulated for added stability. Essential in the up-to-date TV service shop.

MODEL LP-2

$22.50

Shpg. Wt. 7 Lbs.

HEATHKIT CATHODE RAY TUBE CHECKER KIT

This instrument checks cathode emission, beam current, shorted elements, and leakage between elements in electro-magnetic picture tube types. It eliminates all doubt for the TV serviceman, and even more important, for the customer. Features its own self-contained power supply, transformer operated to furnish normal test voltages for the CRT. Employs spring-loaded switches for maximum operator protection. Large 4½" meter indicates CRT condition on "good-bad" scale. Luggage-type portable case ideal for home service calls. Special "shadowgraph" test permits projection of light spot on screen. Also gives relative check of picture tube screen coating.

MODEL CC-1

$22.50

Shpg. Wt. 10 Lbs.

HEATHKIT

MODEL TC-2

$29.50

Shpg. Wt. 12 Lbs.

Tube Checker Kit

This fine piece of test gear checks tubes for quality, emission, shorted elements, open elements, and filament continuity. Will test all tube types normally encountered in radio and TV service work. Sockets provided for 4, 5, 6, and 7-pin large, rectangular, and miniature types, octal and loctal types, the Hytron 9-pin miniatures, and pilot lamps. Condition of tubes indicated on a large 4½" meter with multi-color "good-bad" scale. An illuminated roll chart is built right in, providing test data for various tube types. This tester provides switch selection of 14 different filament voltage values from 0.75 volts to 117 volts. Individual switches control each tube element. Close tolerance resistors employed in critical test circuits for maximum accuracy. A professional instrument both in appearance and performance.

The Model TC-2 is very simple to build, even for a beginner. It employs a color-coded cable harness for neat, professional under-chassis wiring. Comes with attractive counter style cabinet, and portable cabinet is available separately. At this price, even the part-time serviceman can afford his own tube checker for maximum efficiency in service work.

- *Attractive counter-style cabinet.*
- *Wiring-harness simplifies assembly.*
- *Large 4½" meter with two-color "good-bad" scale.*
- *Separate tube element switches prevent obsolescence.*

HEATHKIT TV PICTURE TUBE TEST ADAPTER

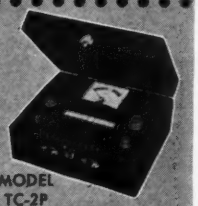
Designed especially for use with the Model TC-2 tube checker. Use it to test TV picture tubes for emission, shorts, etc. Consists of 12-pin TV tube socket, 4 ft. cable, octal connector, and necessary technical data. Not a kit.

MODEL 355

$4.50

Shpg. Wt. 1 Lb.

HEATHKIT PORTABLE TUBE CHECKER KIT



This portable tube checker is identical, electrically, with the Model TC-2. However, it is housed in an attractive and practical carrying case, finished in proxylin impregnated material. The cover is detachable, and the hardware is brass plated. This rugged unit is ideal for home service calls or any portable application.

MODEL TC-2P

$34.50 Shpg. Wt. 15 Lbs.

HEATHKIT VISUAL-AURAL SIGNAL TRACER KIT

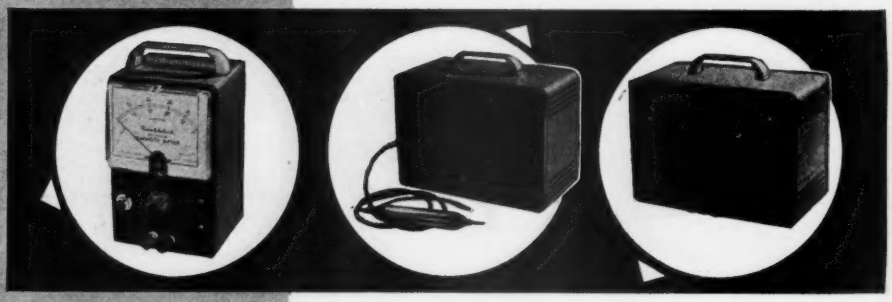
Although designed primarily for radio receiver work, this valuable instrument finds extensive application in FM and TV servicing as well. Features a high-gain channel with demodulator probe, and a low-gain channel with audio probe. Will trace signals in all sections of a radio receiver and in many sections of a FM set or TV receiver. Uses built-in speaker and electron beam eye tube for indication. Also features built-in wattmeter and a noise locater circuit. Provision for patching speaker and/or output transformer into external set.

MODEL T-3

$23.50

Shpg. Wt. 9 Lbs.

HEATHKIT DIRECT READING CAPACITY METER KIT



Operation of this instrument is simplicity itself. One has only to connect a capacitor to the terminals, select the proper range, and read the capacity value directly on the large 4½" meter calibrated in mmf and mfd. Ranges are 0 to 100 mmf, 1,000 mmf, 0.01 mfd, and 0.1 mfd full scale. Precision calibrating capacitors supplied. Not susceptible to hand capacity effects. Residual capacity less than 1 mmf. Especially valuable in production line checking, or in quality control.

MODEL CM-1

$29.50

Shpg. Wt. 7 Lbs.

HEATHKIT CONDENSER CHECKER KIT

The Model C-3 consists of an AC powered bridge for both capacitive and resistive measurements. Bridge balance is indicated on electron beam eye tube, and capacity or resistance value is indicated on front panel calibrations. Measures capacity in four ranges from .00001 mfd to .005 mfd, .001 mfd to .5 mfd, .1 mfd to 50 mfd, and 20 mfd to 1000 mfd. Measures resistance in two ranges, from 100 ohms to 50,000 ohms, and from 10,000 ohms to 5 megohms. Selection of five different polarizing voltages for checking capacitors, from 25 volts DC to 450 volts DC. Checks paper, mica, ceramic, and electrolytic capacitors. Indicates power factor of electrolytic condensers.

MODEL C-3

$19.50

Shpg. Wt. 7 Lbs.

HEATH COMPANY

A Subsidiary of Daystrom, Inc.

BENTON HARBOR 15, MICH.

PIONEER DESIGN . . .

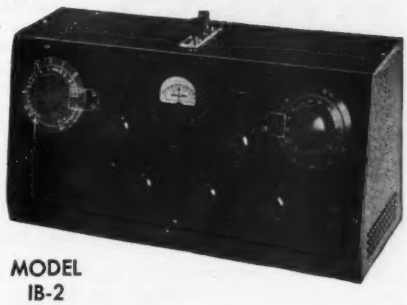
New and unique approaches to instrument and equipment designs are a Heath Company tradition. We concentrate all our development efforts on kit projects, since this is our prime activity—and not just a sideline. This logically results in more efficient, more reliable circuit designs—and you benefit from this constant engineering progress. Buying from the undisputed leader in the electronic kit field assures you of completely modern equipment, with outstanding advanced design features.

HEATHKIT

Impedance Bridge Kit

- ½% precision resistors and silver-mica capacitors.
- Battery-type tubes, no warm-up required.
- Built-in phase shift generator and amplifier.

The Model IB-2 is a completely self-contained unit. It has a built-in power supply, a built-in 1000 cycle generator, and a built-in vacuum tube detector. Provision has been made on the panel for connection to an external detector, an external signal generator, or an external power supply. A 100-0-100 microampere meter on the front panel provides for null indications. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 10 mmf to 100 mfd, inductance from 10 mh to 100 h, dissipation factor (D) from 0.002 to 1, and storage factor (Q) from 0.1 to 1000. ½ of 1% decade resistors employed for maximum accuracy. Typical accuracy figures are: resistance, ±3T; capacitance ±3%; inductance, ±10%; dissipation factor, ±20%; storage factor, ±20%. Employs a Wheatstone bridge, a Capacity Comparison bridge, a Maxwell bridge, and a Hay bridge. Special two-section CRL dial provides maximum convenience in operation. Use the Model IB-2 for determining values of unmarked components, checking production or design samples, etc. A real professional instrument.



MODEL IB-2

$59.50 *Shpg. Wt. 12 Lbs.*

HEATHKIT "Q" METER KIT

The Q Meter permits measurement of inductance from 1 microhenry to 10 millihenries, "W" on a scale calibrated up to 250 full scale, with multiplying factors of 1 or 2, and capacitance from 40 mmf to 450 mmf, ±3 mmf. Built-in variable oscillator permits testing components from 150 kc to 18 mc. Large 4½" panel-mounted meter is features. Very handy for checking peaking coils, chokes, etc. Use to determine values of unknown condensers, both variable and fixed. Compile data for coil winding purposes, or measure RF resistance. Distributed capacity, and Q of coils.

MODEL QM-1

$44.50

Shpg. Wt. 14 Lbs.

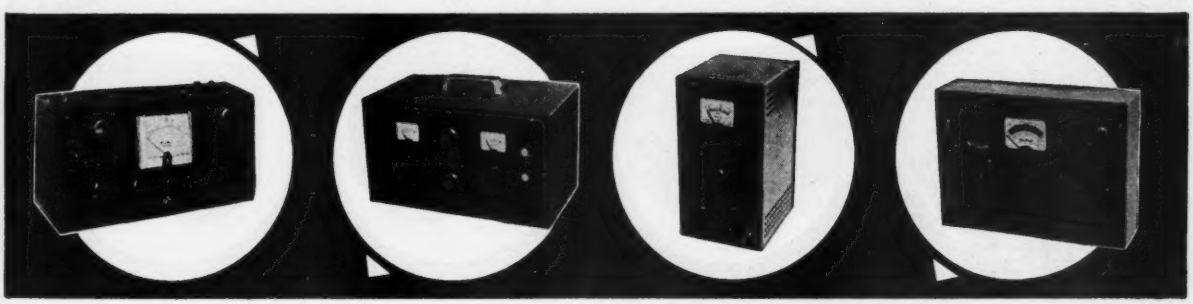
HEATHKIT ISOLATION TRANSFORMER KIT

This device isolates equipment under test from the power line. It is rated at 100 volt-amperes continously, or 200 volt-amperes intermittently. AC-DC sets may be plugged directly into the IT-1 without the chassis becoming "hot." Additionally, since the IT-1 is fused, it is ideal for use as a buffer between the power line and a questionable receiver, or a new piece of equipment. Protects main fuses. Features voltage control, allowing control of the output from 90 volts to 130 volts. Panel meter monitors output voltage. A very handy device at an extremely low price.

MODEL IT-1

$16.50

Shpg. Wt. 9 Lbs.



HEATHKIT 6-12 VOLT BATTERY ELIMINATOR KIT

This completely modern battery eliminator will supply DC output in two ranges for both 6-volt and 12-volt automobile radios. The output is variable for each range, so that operating voltage can be raised or lowered to determine how the receiver functions under adverse conditions. Range is 0-8 volts DC or 0-16 volts DC. Will supply up to 15 amperes on the 6-volt range, or up to 7 amperes on the 12-volt range. Two 10,000 microfarad output filter capacitors insure smooth DC output. Two separate panel meters indicate output voltage or output current. Makes it possible to test automobile radios inside at the workbench. Will also double as a battery charger.

MODEL BE-4

$31.50

Shpg. Wt. 17 Lbs.

HEATHKIT 6-VOLT VIBRATOR TESTER KIT

This instrument functions very much like a tube checker, to test auto radio vibrators. Vibrator condition is indicated on a simple "good-bad" scale. Tests for proper starting and overall quality of operation, of both interrupter and self-rectifier types of 6-volt vibrators The model VT-1 is designed to operate from any battery eliminator capable of delivering continuously variable output from 4 to 6 volts DC at 4 amperes or more. It is an ideal companion unit for the Heathkit Model BE-4 battery eliminator. The construction book for the VT-1 contains vibrator test chart for popular 6-volt vibrator types. A real time saver!

MODEL VT-1

$14.50

Shpg. Wt. 6 Lbs.

HEATHKIT DX-100 PHONE AND CW

MODEL DX-100
Shpg. Wt. 107 Lbs.

$189.50

Shipped motor freight unless otherwise specified. $50.00 deposit required on c.o.d. orders.

- *Phone or CW on 160, 80, 40, 20, 15, 11 and 10 meters.*
- *Built-in VFO, modulator, and power supplies.*
- *High quality components used throughout for reliable performance.*
- *Features 5-point TVI suppression.*

Transmitter Kit

The Heathkit DX-100 transmitter is in a class by itself in that if offers features far beyond those normally received at this price level. It takes very little listening on the bands to discover how many of these transmitters are in operation today. A truly amazing piece of amateur gear. The DX-100 features a built-in VFO and a built-in modulator. It is TVI suppressed, and uses pi network interstage coupling and output coupling. Will match antenna impedances from approximately 50 to 600 ohms. Extensive shielding is employed, and all incoming and outgoing circuits are filtered. The cabinet features interlocking seams for simplified assembly and minimum RF radiation outside of the cabinet. Provides a clean strong signal on either phone or CW, with RF output in excess of 100 watts on phone, and 120 watts on CW. Completely bandswitching from 160 through 10 meters. A pair of 1625 tubes are used in push-pull for the modulator, and the final consists of a pair of 6146 tubes in parallel. The VFO dial and meter face are illuminated, and all front panel controls are located for maximum convenience. Panel meter reads driver plate I, final grid I, final plate I, final plate voltage, and modulator current. The chassis is constructed of heavy #16 gauge copper-plated steel. Other high-quality components include potted transformers, ceramic switch and variable capacitor insulation, silver-plated or solid-silver switch terminals, etc. All coils are pre-wound, and the main wiring cable is pre-harnessed. The kit can be built by a beginner from the comprehensive step-by-step instructions supplied. It is a proven, trouble-free rig, that will insure many hours of "on-the-air" enjoyment in your ham shack.

HEATHKIT COMMUNICATIONS TYPE ALL BAND RECEIVER KIT

This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short-wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image rejection. Amateur bands clearly marked on illuminated dial scale. Employs transformer type power supply—electrical bandspread—antenna trimmer—separate RF and AF gain controls—noise limiter—headphone jacks—and automatic gain control. Has built-in VFO for CW-reception.

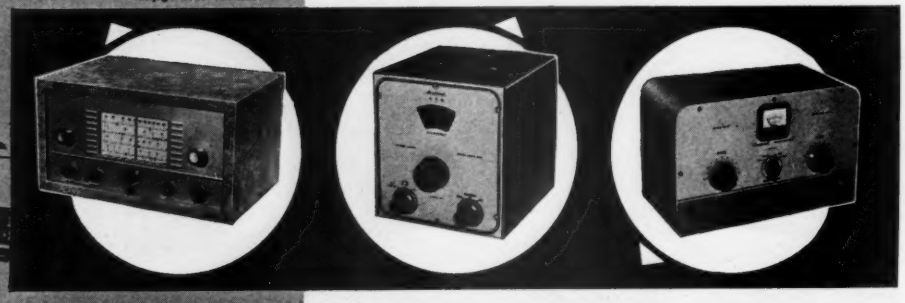
CABINET: Fabric covered cabinet with aluminum panel as shown. Part 91-15A. Shipping weight 5 Lbs. $4.95

MODEL AR-3
$30.75
INCLUDING NEW EXCISE TAX
(Less Cabinet)
Shpg. Wt. 12 Lbs.

HEATHKIT VFO KIT

You can go VFO for less than you might expect. Here is a variable frequency oscillator that covers 160, 80, 40, 20, 15, 11, and 10 meters with three basic oscillator frequencies, that sells for less than $20. Provides better than 10 volt average RF output on fundamentals. Plenty of drive for most modern transmitters. Requires a power source of only 250 VDC at 15 to 20 ma. and 6.3 VAC at 0.45A. Incorporates a regulator tube for stability. Illuminated frequency dial reads frequency directly on the band being employed. Temperature-compensated capacitors offset coil heating.

MODEL VF-1
$19.50
Shpg. Wt. 7 Lbs.



EASY ON THE BUDGET!

You can buy Heathkits on an easy time-payment plan that provides a full year to pay. Write for complete details and special order blank.

HEATHKIT CW TRANSMITTER KIT

This is the original low-priced Heathkit CW transmitter. Its reliable performance has been proven time and time again on the CW bands. Designed for crystal control, the Model AT-1 covers 80, 40, 20, 15, 11, and 10 meters. May be excited from external VFO. Plate power input up to 30 watts. Power supply built in. Panel meter indicates grid current or plate current for final. Incorporates pre-wound coils, copper-plated chassis, built-in line filter, profuse shielding, and top-quality parts throughout. Crystal socket and key jack on front panel. Built-in key-click filter, and single-knob bandswitching. 52-ohm coaxial output. Uses 6AG7 oscillator-multiplier, 6L6 power amplifier-doubler, and 5U4G rectifier.

MODEL AT-1
$29.50
Shpg. Wt. 15 Lbs.

HEATH COMPANY
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BENTON HARBOR 15, MICH.

DOLLAR-SAVING ECONOMY . . .

There would be no particular achievement in selling inexpensive merchandise at a low price—although it is being done every day. However, there is something to crow about when, through tremendous purchasing power and factory-to-you distribution, Heath Company can offer top-quality equipment, using name-brand components, at such low prices. This is real economy, as opposed to the so-called "bargains". Needless to say, there is a big difference.

HEATHKIT PHONE AND CW
Transmitter Kit

- *6146 final amplifier for full 65-watt plate power input.*
- *Phone and CW operation on 80, 40, 20, 15, 11, and 10 meters. Pi network output coupling.*
- *Switch selection of three crystals — provision for external VFO excitation.*

The DX-35 features a 6146 final amplifier to provide 65 watts plate power input on CW, with controlled carrier modulation peaks up to 50 watts on phone. In addition, it is a most attractive transmitter. Modulator and power supplies are built-in, and the rig covers 80, 40, 20, 15, 11, and 10 meters with a single band-change switch. Pi network output coupling provided for matching various antenna impedances. A 12BY7 buffer stage provided ahead of the final amplifier for plenty of drive on all bands. 12BY7 oscillator and 12AU7 modulator. Provision for switch selection of three different crystals. Crystals reached through access door at rear. Front panel controls marked "off—CW—stand-by—phone", "final tuning", "antenna coupling", "drive level control", and "band change switch". Panel meter indicates final grid current or final plate current. A perfect low-power transmitter both for the novice, and for the more experienced operator. A remarkable power package for the price. Incidentally, the price includes tubes, and all other components necessary for assembly. As with all Heathkits, comprehensive instruction manual assures successful assembly.

MODEL DX-35

$56.95 *Shpg. Wt. 24 Lbs.*

HEATHKIT ANTENNA IMPEDANCE METER KIT

This instrument employs a 100 microampere panel meter and covers the impedance range of 0-600 ohms for RF tests. Functions up to 150 mc. Used in conjunction with signal source, such as the Heathkit Model GD-1B grid dip meter, the Model AM-1 will determine antenna resistance and resonance, match transmission lines for minimum standing wave ratio, determine receiver input impedance, etc. Will also double as a phone monitor. A very valuable device for many uses in the ham shack.

MODEL AM-1

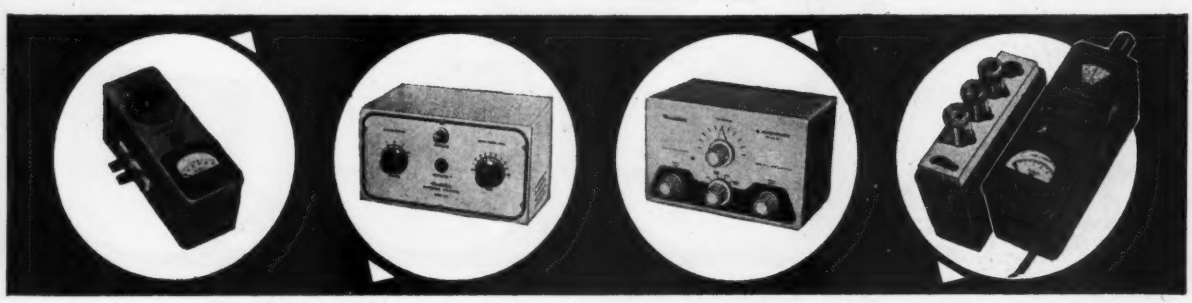
$14.50 *Shpg. Wt. 2 Lbs.*

HEATHKIT "Q" MULTIPLIER KIT

The QF-1 functions with any receiver with an IF frequency between 450 and 460 kc that is not AC-DC type. Operates from the receiver power supply, requiring only 6.3 VAC at 300 ma. and 150 to 250 VDC at 2 ma. Simple to connect with cable and plugs supplied. Provides additional selectivity for separating two signals, or will reject one signal and eliminate heterodyne. A big help on crowded bands. Provides an effective Q of approximately 4,000 for sharp "peak" or "null". Tunes to any signal within the IF bandpass of the receiver, without changing main receiver tuning dial.

MODEL QF-1

$9.95 *Shpg. Wt. 3 Lbs.*



HEATHKIT ANTENNA COUPLER KIT

This device is designed to match the Model AT-1 transmitter to a long-wire antenna. In addition to impedance matching, this unit incorporates an L-type filter which attenuates signals above 36 megacycles, thereby reducing TVI. Designed for 52 ohm coaxial input. Handles power up to 75 watts, 10 through 80 meters. Uses a tapped inductor and variable capacitor. Neon RF indicator on front panel. Copper-plated chassis—high quality components throughout—simple to build. Eliminates waste of valuable communications power due to improper matching. A "natural" for all AT-1 transmitter owners.

MODEL AC-1

$14.50 *Shpg. Wt. 4 Lbs.*

HEATHKIT GRID DIP METER KIT

The grid dip meter was originally designed for the ham shack. However, its use has been extended into the service shop and laboratory. Continuous frequency coverage from 2 mc to 250 mc with pre-wound coils. 500 microampere panel meter employed for indication. Use for locating parasitics, neutralizing, determining RF circuit resonant frequencies, etc. Coils are included with kit, as is a coil rack. Front panel controls include sensitivity control for meter, and phone jack for listening to zero-beat. Will also double as an absorbtion-type wavemeter.

MODEL GD-1B

$19.95 *Shpg. Wt. 4 Lbs.*

HEATHKIT BROADCAST BAND

MODEL BR-2
(Less Cabinet)
Shpg. Wt. 10 Lbs.

$19.95
INCLUDING NEW EXCISE TAX*

Receiver Kit

You need no previous experience in electronics to build this table-model radio. The Model BR-2 receiver covers 550 kc to 1620 kc and features good sensitivity and selectivity over the entire band. A 5½" PM speaker is employed, along with high gain miniature tubes and a new rod-type built-in antenna. Provision has been made in the design of this receiver for its use as a phonograph amplifier. The phono jack is located on the back chassis apron. A transformer operated power supply is featured for safety of operation, as opposed to the usual AC-DC supply commonly found in "economy radio kits." Don't let the low Heathkit price deceive you. This is the kind of set you will want to show off to your family and friends after you have finished building it.

Construction of this radio kit is very simple. Giant size pictorial diagrams and detailed step-by-step instructions assure your success. The construction manual also includes an explanation of basic receiver circuit theory so you can "learn by doing" as the receiver is built. The manual even provides information on resistor and capacitor color codes, soldering techniques, use of tools, etc. If you have ever had the urge to build your own radio receiver, the outstanding features of this popular Heathkit deserve your attention.

ATTENTION BEGINNERS . . .

This kit is an ideal "first project" if you have never built a Heathkit before. A good chance to "learn by doing."

- *Miniature tubes and high-gain IF transformer.*
- *Rod-type built-in antenna. Good sensitivity and selectivity.*
- *5½-inch PM speaker.*
- *Provision for phono jack.*
- *Transformer - operated power supply.*

CABINET: Proxylin impregnated fabric covered plywood cabinet available for the BR-2 receiver as shown. Complete with aluminum panel, reinforced speaker grill, and protective rubber feet. Shipping weight 5 lbs., part No. 91-9A.....$4.95*

HEATHKIT PROFESSIONAL RADIATION COUNTER KIT

This sensitive and reliable instrument has already found extensive application in prospecting, and also in medical and industrial laboratories. It offers outstanding performance at a reasonable price. Front-panel meter indicates radiation level, and oral indication produced by panel-mounted speaker. Meter ranges are 0-100, 600, 6,000 and 60,000 counts per minute, and 0—.02, .1, 1 and 10 milliroentgens per hour. The probe, with expansion cord, employs type 6306 bismuth counter tube, sensitive to both beta and gamma radiation. It is simple to build, even for a beginner.

MODEL RC-1
$79.95
Shpg. Wt. 8 Lbs.

HEATHKIT CRYSTAL RECEIVER KIT

The crystal radio of Dad's day is back again, but with big improvements! The Model CR-1 employs a sealed germanium diode, eliminating the critical "cat's whisker" adjustment. It is housed in a compact plastic box, and features two Hi-Q tank circuits, employing ferrite core coils and variable air tuning capacitors. The CR-1 covers the standard broadcast band from 540 kc to 1600 kc, and no external power is required for operation. Could prove valuable for emergency signal reception, This easy-to-build kit is a real "learn by doing" experience for the beginner, and makes an interesting project for all ages.

MODEL CR-1
$8.75
INCLUDING NEW EXCISE TAX*
Shpg. Wt. 3 Lbs.

- *Amazing new circuit for high efficiency.*
- *Compact, portable and rugged.*
- *Stable circuit requires only one 67½ volt "B" battery and two 1½ volt "A" batteries.*

HEATHKIT ENLARGER TIMER KIT

The Model ET-1 is an easy-to-build device for use by amateur or professional photographers in controlling the timing cycle of an enlarger. It covers the range of 0 to 1 minute with a continuously variable, clearly calibrated scale. The timing period is pre-set, and the timing cycle is initiated by depressing the spring-return switch to the "print" position. Front panel provision is made for plugging in the enlarger and a safelight. The safelight is automatically turned "on" when the enlarger is "off". Handles up to 350 watts. The timing cycle is controlled electronically for maximum accuracy and reliability. Very simple to build in only one evening, even by a beginner.

MODEL ET-1
$11.50
Shpg. Wt. 3 Lbs.

HEATH COMPANY
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BENTON HARBOR 15, MICH.

COMPREHENSIVE INSTRUCTIONS . . .

The step-by-step assembly instructions provided with each Heathkit are the finest available anywhere. Each manual begins at the beginning, and assumes no previous training or experience on the part of the kit builder. This means that our kits can be built successfully by anyone who can follow instructions. As a matter of fact, new manuals are tested by having the kit built by someone in our office who has had no previous experience in electronics. This is your guarantee of complete and thorough instruction material.

HEATHKIT HIGH FIDELITY

Preamplifier Kit

- *5 switch-selected inputs, each with its own level control.*
- *Equalization for LP, RIAA, AES, and Early 78's.*
- *Separate bass and treble tone controls, and special hum control.*
- *Clean, modern lines and satin-gold enamel finish.*

Literally thousands of these preamplifiers are in use today, because the kit meets or exceeds specifications for the most rigorous high-fidelity applications, and will do justice to the finest available program sources. Provides a total of 5 inputs, each with individual level controls (three high-level and two low-level). Frequency response is within 1 DB from 25 CPS to 30,000 CPS, or within 1½ DB from 15 CPS to 35,000 CPS. Hum and noise are extremely low, with special balance control for absolute minimum hum level. Tone control provides 18 DB boost and 12 DB cut at 50 CPS, and 15 DB boost and 20 DB cut at 15,000 CPS. Cabinet measures only 12-9/16" W. x 3⅜" H. x 4⅞" D, and it is finished in beautiful satin-gold enamel. 4-position turnover and 4 position roll-off controls provide "LP," "RIAA," "AES," and "early 78" equalization, and 8, 12, 16, and 1 flat position for roll-off. Derives operating power from the main amplifier, requiring only 6.3 VAC at 1 ampere and 300 VDC at 10 MA. Easy to construct from step-by-step instructions and pictorial diagrams provided.

MODEL WA-P2 *(With Cabinet) Shpg. Wt. 7 Lbs.*

$19.75

HEATHKIT HIGH FIDELITY FM TUNER KIT

- *Illuminated slide-rule dial covers 88 to 108 MC.*
- *Modern circuit emphasizes sensitivity and stability.*
- *Housed in attractive satin-gold cabinet to match WA-P2 and BC-1.*

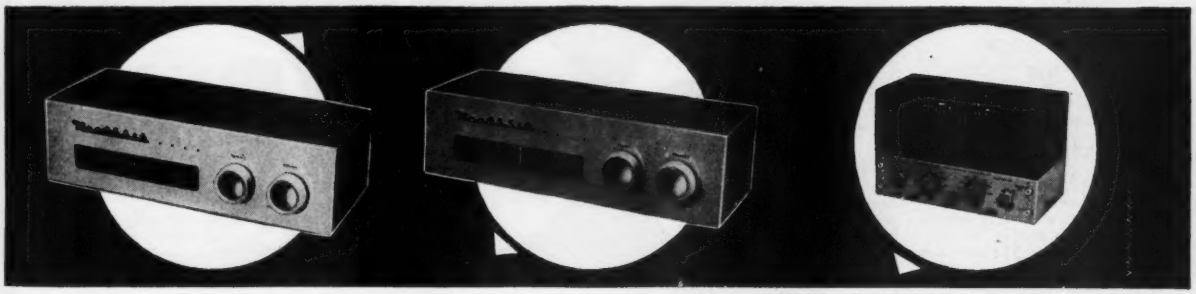
This amazing new FM tuner can provide you with real high-fidelity performance at an unbelievably low price level. Covering 88 to 108 MC, the modern circuit features a stabilized, temperature-compensated, oscillator, A.G.C., broadbanded IF circuits, and better than 10 UV sensitivity for 20 DB of quieting. A high gain, cascaded, RF amplifier is used ahead of the mixer to increase overall gain and reduce oscillator leakage. It employs a ratio detector for high efficiency without sacrifice in high-fidelity performance. IF and ratio transformers are pre-aligned, as is the front end tuning unit. This means the kit can be constructed by a beginner, without elaborate test and alignment equipment. The FM-3A is designed to match the WA-P2 preamplifier and the BC-1 AM tuner. An illuminated slide-rule dial is employed for frequency indication. Step-by-step instructions and large pictorial diagrams assure success.

MODEL FM-3A

$26.95

INCLUDING NEW EXCISE TAX‡

(With Cabinet) Shpg. Wt. 7 Lbs.



HEATHKIT BROADBAND AM TUNER KIT

This AM tuner has been designed especially for high-fidelity applications. It incorporates a low-distortion detector, a broadband IF, and other features essential to usefulness in high-fidelity. Special voltage-doubler detector employs crystal diodes for low distortion. Sensitivity and selectivity are excellent. Audio response is ± 1 DB from 20 CPS to 2 kc, with 5 DB of pre-emphasis at 10 kc to compensate for station roll-off. Covers the standard broadcast band from 550 to 1600 kc. Incorporates a 10 kc whistle-filter and provides a 6 DB signal-to-noise ratio at 2.5 UV. RF and IF coils are pre-aligned, and power supply is built-in. Incorporates AVC, two outputs, and two antenna inputs.

MODEL BC-1

$26.95

INCLUDING NEW EXCISE TAX‡

(With Cabinet) Shpg. Wt. 8 Lbs.

HEATHKIT ELECTRONIC CROSS-OVER KIT

This unusual device functions to separate low frequencies and high frequencies so that they may be fed to separate amplifiers and to separate speakers. This eliminates the need for conventional cross-over circuits, since the Model XO-1 does the complete job electronically. Cross-over frequencies of 100, 200, 400, 700, 1,200, 2,000 and 35,000 CPS are selectable with front panel controls on the XO-1, and a separate level control is provided for each channel. Minimizes intermodulation distortion problems. Handles unlimited power, since frequency division is accomplished ahead of the power stage. Attenuation is 12 DB per octave, with sharp "knee" at cut-off frequency.

MODEL XO-1

$18.95

Shpg. Wt. 6 Lbs.

HEATHKIT ADVANCED-DESIGN

MODEL W-5M
Shpg. Wt. 31 Lbs
Express Only

$59.75

MODEL W-5

Consists of Model W-5M *plus* Model WA-P2 preamplifier.

Shpg. Wt. 38 Lbs.
Express only....$79.50

- *Full 25 watt output with KT-66 output tubes.*
- *All connectors brought out to front chassis apron.*
- *Protective cover over all above-chassis components.*

HIGH FIDELITY

Amplifier Kit

This 25 watt unit is our finest high-fidelity amplifier. Using a special design peerless output transformer, and KT-66 output tubes by Genalex, the Model W-5M provides performance characteristics unsurpassed at this price level. Frequency response is ± 1 DB from 5 to 160,000 CPS at 1 watt. Harmonic distortion is less than 1% at 25 watts and 1M distortion is less than 1% at 20 watts (60 and 3,000 CPS, 4 to 1). Hum and noise are 99 DB below 25 watts. Damping factor is 40 to 1. Input voltage for 5 watts output is 1 volt. Tubes employed are a pair of 12AU7's, a pair of KT-66's and a 5R4GY rectifier. Measures 13-3/32" W. x 8½" D. x 8¼" H. Output impedance is 4, 8, or 16 ohms. Featured, also, is the "tweeter saver" which suppresses high frequency oscillation, and a new type balancing circuit requiring only a voltmeter for indication. This balance is easier to adjust, and results in a closer "dynamic" balance between output tubes. The Model W-5M provides improved phase shift characteristics, reduced IM and harmonic distortion, and improved frequency response. Conservatively rated high-quality components are used throughout to insure years of trouble-free operation. No technical background or training is required for assembly. Step-by-step instructions are provided for every stage of construction, and large pictorial diagrams illustrate exactly where each wire and component is to be placed. An amplifier for music lovers who can appreciate subtle differences in performance. Just ask the audiofile who owns one!

HEATHKIT DUAL-CHASSIS—WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

This 20-watt high-fidelity amplifier employs the famous Acrosound Model TO-300 "ultra-linear" output transformer and uses 5881 output tubes. The power supply is built on a separate chassis, and the two chassis are inter-connected with a power cable. This provides additional flexibility in mounting. Frequency response is ± 1 DB from 6 CPS to 150 kc at 1 watt. Harmonic distortion is only 1% at 21 watts, and IM distortion is only 1.3% at 20 watts. (60 and 3,000 CPS). Output impedance is 4, 8, or 16 ohms. Hum and noise are 88 DB below 20 watts. A very popular high-fidelity unit employing top-quality components throughout.

MODEL W-3M: Shpg. Wt. 29 Lbs. Express only.....$49.75

MODEL W-3: Consists of Model W-3M *plus* Model WA-P2 preamplifier. Shpg. Wt. 37 Lbs. Express only.....$69.50

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The 20-watt Model W-4AM Williamson type amplifier is a tremendous high-fidelity bargain. Combining the power supply and main amplifier on one chassis, and using a special-design output transformer by Chicago Standard brings you savings without a sacrifice in quality. Employing 5881 output tubes, the frequency response of the W-4AM is ± 1 DB from 10 CPS to 100 kc at 1 watt. Harmonic distortion is only 1.5% at 20 watts. Output impedance is 4, 8, or 16 ohms. Hum and noise are 95 DB below 20 watts.

MODEL W-4AM: Shpg. Wt. 28 Lbs. Express only.....$39.75

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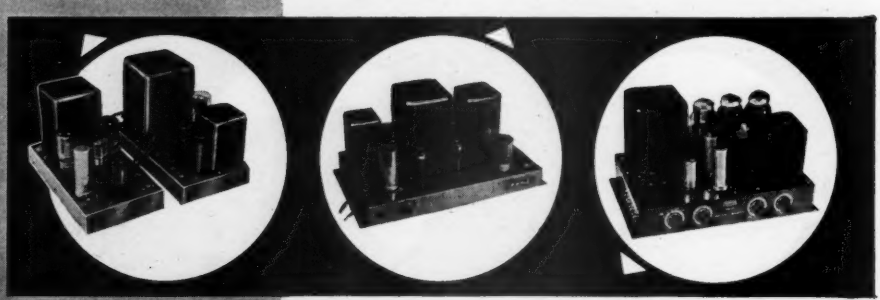
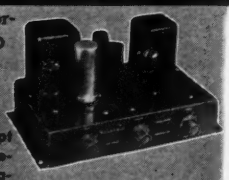
HEATHKIT 7-WATT AMPLIFIER KIT

This amplifier is more limited in power than other Heathkit models, but it still qualifies as a high-fidelity unit, and its performance definitely exceeds that of many so-called "high-fidelity" phonograph amplifiers. Using a tapped-screen output transformer of new design, the Model A-7D provides a frequency response of ± 1½ DB from 20 to 20,000 CPS. Total distortion is held to a surprisingly low level. Output stage is push pull, and separate bass and treble tone controls are provided. Shpg. Wt. 10 Lbs.

MODEL A-7D
$18.65*
INCLUDING NEW EXCISE TAX*

MODEL A-7E: Similar to the A-7D, except that a 12SL7 tube has been added for preamplification. Two inputs, RIAA compensation, and extra gain. **$20.35***





HEATHKIT 20-WATT HIGH FIDELITY AMPLIFIER KIT

This high-fidelity amplifier features full 20-watt output using push pull 6L6 tubes. Built-in preamplifier provides 4 separate inputs, selected by a panel-mounted switch. It has separate bass and treble tone controls, each offering 15 DB boost and cut. Output transformer is tapped at 4, 8, 16, and 500 ohms. Designed primarily for home installations, but also used extensively for public address applications. True high-fidelity performance with frequency reponse of ± 1 DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

MODEL A-9B
$35.50*
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HEATH COMPANY
A Subsidiary of Daystrom, Inc.
BENTON HARBOR 15, MICH.

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Thank you,
HEATH COMPANY

HEATHKIT HIGH FIDELITY

Range Extending
SPEAKER SYSTEM KIT

- *High quality speakers of special design — 15" woofer and compression-type super-tweeter.*
- *Easy-to-assemble cabinet of furniture-grade plywood.*
- *Attractively styled to fit into any living room. Matches Model SS-1.*

MODEL SS-1B

$99.95

Shpg. Wt. 80 Lbs.

This range extending unit is designed especially for use with the Model SS-1 speaker system. It consists of a 15" woofer, providing output between 35 and 600 CPS, and a compression-type super-tweeter that provides output between 4,000 and 16,000 CPS. Cross-over frequencies are 600, 1,600, and 4,000 CPS. The SS-1 provides the mid-range, and the SS-1B extends the coverage at both ends of the spectrum. Together, the two speaker systems provide output from 35 to 16,000 CPS within ± 5 DB. This easy-to-assemble speaker enclosure kit is made of top-quality furniture-grade plywood. All parts are pre-cut and pre-drilled, ready for assembly and the finish of your choice. Complete step-by-step instructions are provided for quick assembly by one not necessarily experienced in woodworking. Coils and capacitors for proper cross-over network are included, as is a balance control for super-tweeter output level. The SS-1 and SS-1B can provide you with unbelievably rich audio reproduction, and yet these units are priced reasonably. The SS-1B measures 29" H. x 23" W. x 17½" D. The speakers are both special-design Jensens, and the power rating is 35 watts. Impedance is 16 ohms.

HEATHKIT HIGH FIDELITY

SPEAKER SYSTEM KIT

MODEL SS-1

$39.95

Shpg. Wt. 30 Lbs.

- *Special design ducted-port, bass-reflex enclosure.*
- *Two separate speakers for high and low frequencies.*
- *Kit includes all parts and complete instructions for assembly.*

This speaker system is a fine reproducer in its own right, covering 50 to 12,000 CPS within ± 5 DB. However, the story does not end there. Should you desire to expand the system later, the SS-1 is designed to work with the SS-1B range extending unit — providing additional frequency coverage at both ends of the spectrum. It can fulfill your present needs, and still provide for the future. The SS-1 uses two Jensen speakers; an 8" midrange-woofer, and a compression-type tweeter. Cross-over frequency is 1,600 CPS, and the system is rated at 25 watts. Nominal impedance is 16 ohms. The cabinet is a ducted-port bass-reflex type. Attractively styled, the Model SS-1 features a broad "picture-frame" molding that will blend with any room decorating scheme. Pre-cut and pre-drilled wood parts are of furniture grade plywood. The kit is easy-to-build, and all component parts are included, along with complete step-by-step instructions for assembly. Can be built in just one evening, and will provide you with many years of listening enjoyment thereafter.

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Push-button Remote TV Tuning

Fig. 1. Motor and control unit are mounted directly under tuner. The numbered adjustment screws are tightened to close contacts on unused channels, and loosened on all channels that are active in the reception area.

By
PERRY SHENEMAN

An Admiral unit automatically seeks active channels, also provides on-off and volume control facilities.

A UNIQUE and interesting design feature in automatic tuning methods is being used by *Admiral Corporation* in one model of its automatic power tuning receiver line.

After initial adjustments, each time the automatic tuning unit is energized, the tuner will automatically advance in a clockwise direction, past non-operating channels, and stop when an operating channel is reached. The automatic tuning unit can be energized by the automatic tuning button located at the receiver, or by a hand operated remote control device.

A 1/400th horsepower, 117 volt a.c. shaded-pole motor supplies the power for the automatic tuning unit. A gear train, in reducing the initial 1750 rpm of the armature, applies a torque of 90 inch-ounces to the tuner shaft and rotates the tuner about one revolution in 4 seconds. The 90 inch-ounces of torque is sufficient, not only to overcome the resistance offered by the tuner detent spring, but to hold the channel selection knob securely enough to prevent the tuner from turning unless forced. After the automatic tuning unit has been energized and the motor is rotating the tuner, an ingenious, yet simple, switch assembly determines where the tuner will stop.

The switch assembly consists of a 12-position wafer type switch mounted on a printed circuit board. A circuit for each contact of the wafer switch, representing the 12 positions of the tuner, is developed on the board by the etched copper process. See Fig. 3. The switch assembly is wired in series with the motor. One side of the motor is connected directly to one side of the a.c. line, whereas the other side of the motor is connected to the contact (common) blade of the switch assembly. The circuit is completed through one or more of the 12 circuits of the printed circuit board. Each of the 12 circuits may be opened or closed by a specially designed printed circuit washer and adjustment screw.

When the initial adjustments are performed for a given area, the adjustment screws are tightened (closing the circuit), for all non-operating channels and loosened (opening the circuit), for all operating channels, therefore, when the tuning button is pressed, the tuner will rotate through the closed circuits and stop when it reaches a circuit left in the open position.

As an illustration of the operating principle of the automatic tuning printed circuit switch assembly, assume the Channel Selector is at rest at the channel 13 position.

The tuner is, for example, to turn automatically through channels 2, 3, and 4 without stopping, and, to stop on channel 5. Since channels 2, 3, and 4 are considered, for the purpose, as "non-operating" channels, the corresponding circuits on the wafer switch must be closed. Therefore, the adjustment screws for these channels are turned counterclockwise until snug. See photo. Channel 5 is the operating channel where the tuner is to stop, so the adjustment screw for that channel is turned about two turns clockwise to open the circuit.

When the automatic tuning button (wired directly to the motor) is pressed, the motor receives an instantaneous yet sufficient surge of voltage to rotate about 3 degrees. This small degree of rotation will shift the contact blade of the wafer switch from channel 13 terminal (an open circuit) to channel 2 terminal.

Since the circuit of the channel 2 terminal on the wafer switch presents a closed circuit because of the adjustment screw setting, the motor continues to turn, rotating the contact blade toward the channel 3 terminal. When the contact blade of the wafer switch has reached channel 3 and then channel 4 positions, the same condition exists as with the channel 2 terminal; the circuits have been closed by the adjustment screw. However, when the motor has rotated the contact blade to the channel 5 position, the motor stops because the adjustment screw for that channel was left in the open circuit position.

The question may arise regarding the reason the motor stops on the channel 5 terminal position at all, since there is considerable space between the contacts of the switch.

Close examination of the contact blade of the wafer switch will disclose that the width of the blade is just sufficient to engage two contacts simultaneously.

Referring back to the hypothetical setup procedure previously described, it is easily seen that the contact blade of the wafer switch in turning from the channel 4 terminal position, which is "live," to the channel 5 position (an open circuit), remains in contact with the channel 4 terminal long enough for the tuner to detent in the channel 5 position before the circuit is broken.

The rotor or armature of the motor is spring loaded to disengage from the

reduction gear train whenever power is not applied to the motor. This spring loading or clutch action of the rotor releases the tuner from the drag of the reduction gear train for manual operation of the Channel Selector.

Service Hints on Mechanism

Motor fails to turn: Should the motor fail to run when the automatic tuning button is pressed, check the "automatic-manual" switch located at the rear of the cabinet. The switch should be in the "automatic tuning" position.

Carefully inspect all solder connections on the "automatic-manual" switch, the motor, motor energizing switch, and the printed circuit switch assembly.

A check of the motor energizing switch is easily made. Place the leads of an ohmmeter across the switch with the selector switch of the ohmmeter set to R x 1 position.

A reading of infinity or "open" will show on the meter. Pressing the automatic tuning button should cause the needle of the meter to fall to zero. No action of the needle indicates an open switch.

At the same time a check of the motor winding can be made. Place the leads of the ohmmeter across the terminals of the motor windings. A reading of 30 ohms is normal and indicates a satisfactory motor.

Removing the motor: If it is necessary to remove the motor, use the following procedure.

a. Unsolder yellow and orange wires completely from motor energizing switch (above motor) noting the location of each wire.

b. Remove the ¼ in. self-tapping screws located one on each side of the motor gear housing.

c. Pull motor straight back. The push rod will remain with the motor. Care should be taken not to bend the push rod.

Caution: Whenever the motor has been loosened or removed from the mounting plate, it must be replaced in the identical position from which it was removed. If the motor is not aligned with the tuner shaft, binding may occur, which will keep the motor from rotating the tuner over the detent.

If necessary, loosen the ¼ in. self-tapping screws holding the motor assembly to the mounting plate and shift motor in the necessary direction.

Check the automatic tuning operation thoroughly before assuming a satisfactory position has been reached.

Removing the printed circuit switch assembly: To remove the automatic tuning printed wiring switch assembly, proceed as follows:

a. Remove the motor according to instructions under heading "Removing the motor."

b. Remove the two *Phillips*-head type screws and ¼ in. self-tapping screw holding switch assembly.

c. Pull switch assembly directly from tuner shaft.

Important: When replacing the printed circuit switch assembly, the contact wiper of the 12 position wafer switch must be under a terminal corresponding to a similar channel on the tuner. A good procedure to follow is thus:

a. Set Channel Selector to channel 13.

b. Position the contact wiper of the 12 position wafer switch under the channel 13 terminal as shown in Fig. 2.

c. Slide wafer switch over tuner shaft and replace screw.

d. Replace motor.

Channel selector difficult to turn manually: Although channel selection by automatic tuning will be the preferred method of changing stations, it is possible to change stations manually.

A condition may arise where even though the automatic-manual switch is in the manual tuning position, the operator will find the Channel Selector knob extremely difficult to turn. Should such a situation be encountered, check the rotor of the automatic tuning motor.

The rotor is "spring loaded" to retract from the reduction gear train whenever power is not applied to the motor. Removing the rotor permits "free wheeling" of the tuner for manual channel selection.

If the compression type spring that pushes the rotor away from the gear train is weak, or should the rotor be stuck because of foreign matter, the rotor will remain engaged with the gear train and the tuner will be difficult to rotate manually.

Remote Control Operation

The Remote Control Unit is designed to permit the operator to change channels automatically, control the volume, and turn the set "on" and "off" from distances up to 25 feet from the receiver. The electrical components which make up this Remote Unit are a motor energizing switch, "on-off" switch, and a volume control.

The "on-off" switch at the Remote Unit is in parallel with the "on-off" switch at the set, therefore, the receiver must be turned on and off at the same point. If the set is turned on, and at a subsequent time the Remote is also turned on, then it will be necessary to turn both the set and the Remote off.

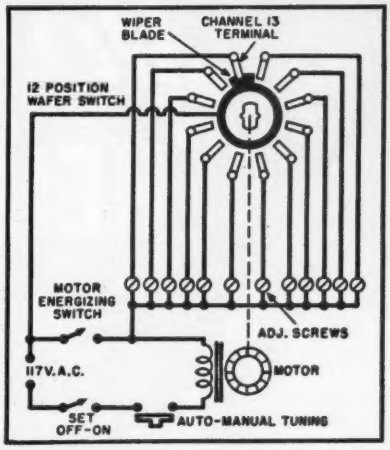


Fig. 2. Wiring diagram to motor that rotates tuner. Depressing the energizing switch starts the motor and rotates the switch to the next channel setting. If the adjustment screw for that setting is closed, it completes the circuit as did depressing the motor switch, keeps the motor going till the next position is reached. If the screw is open, no power reaches the motor, automatic tuning stops.

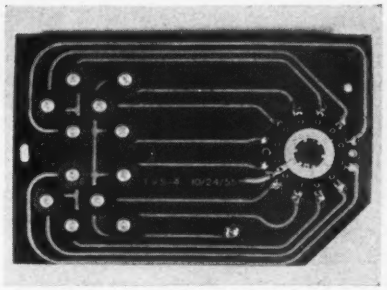
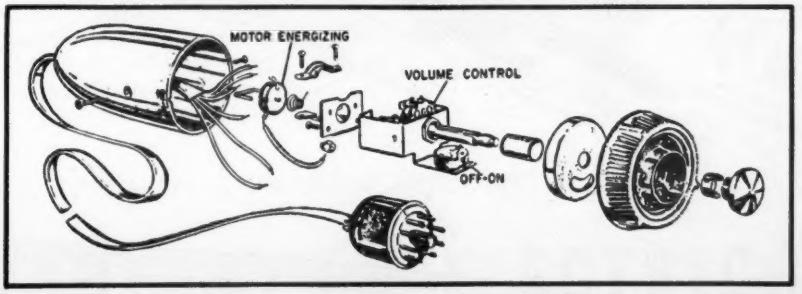


Fig. 3. The reverse side of the screw adjustment board shown in Fig. 1 reveals printed wiring between points on switch assembly and individual adjustment screws.

The volume control at the set is of conventional design. The volume control at the Remote is connected in series with the screen grid of the sound i.f. amplifier, thus, if the Remote volume control is turned to maximum, or all the way to the right, full control over the audio output level will be attained at the receiver.

There is a switch in the socket for the Remote plug which closes and completes the audio "B+" circuit when the Remote Unit is not plugged in. -30-

Fig. 4. Exploded view of remote assembly shows location of "on-off" switch, remote volume control, channel selecting (motor energizing) control, housing for complete remote unit, extension cable, and plug for interconnecting to TV set.



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Modifying the Heathkit Linearity Pattern Generator

By **J. FRANK BRUMBAUGH**

Project Engr., Heath Company

WANT to bring your *Heathkit* Model LP-1 linearity pattern generator up-to-date? It's easy and costs practically nothing. It takes only a few minutes' work to have a brand new LP-2!

The modification is in two parts: making provision for external synchronization and reducing the number of bars visible on the television screen. Only the addition of a "Sync Input" is necessary, since the number of bars displayed is a matter of personal preference.

Those of you who have used the LP-1 know that its stability leaves something to be desired. The addition of external sync from the TV set may prevent a lot of black thoughts and purple-tinged air when the pattern slips just as an adjustment is to be made. With the proper sync the pattern will be rock steady during all the knob twisting required to put an ailing TV set back on its feet.

Reference to the schematic diagram of Fig. 1 will readily show the simplicity of the suggested modification. One resistor, one capacitor, a binding post, and a one-lug terminal strip are all the additional parts required.

Actual Modification

First, remove one screw holding the tuning capacitor to the chassis. This should be the screw closest to the panel. Mount a single (ungrounded) terminal over this screw and tighten the screw. Next connect a 10 $\mu\mu$fd. capacitor between pin 6 of V_5 and the terminal strip. Solder pin 6 of V_5 only.

Now connect a 150,000 ohm, ½ watt resistor between pin 1 of V_3 and K_1. Solder pin 1 of V_3 only. Drill a hole in the panel between the "RF Gain" control and "Function" switch. Mount an *insulated* binding post in this hole. Solder a wire to the junction of the 10 $\mu\mu$fd. capacitor and the one-lug terminal strip and connect to the binding post. Solder a wire to K_1 and solder the other end to the binding post.

This completes the external sync modification. In use, a length of hook-up wire is attached to the "Sync" binding post just installed and the other (insulated) end is poked into the set near the yoke on the TV tube. If the back has been removed from the TV set, the sync wire may be loosely wrapped or tied around the yoke leads. Enough synchronizing pulses to completely lock-in the pattern display will be introduced from the TV set into the linearity pattern generator.

For those who desire fewer bars or dots for display, with the added feature of more vernier horizontal and vertical tuning, the following modification will suffice.

Replace the present horizontal control with a 100,000 ohm potentiometer and change the 220,000 ohm resistor between pin 6 of V_5 and L_1 to a 330,000 ohm, ½ watt unit. Replace the vertical control with a 20,000 or 25,000 ohm potentiometer and change the 47,000 ohm resistor between pin 6 of V_3 and T_1 to a 100,000 ohm, ½ watt unit.

Be sure all connections are well soldered before putting the instrument back in its case. These modifications are simple to do, but a few moments' work with a TV set will be proof of the value of such changes. -30-

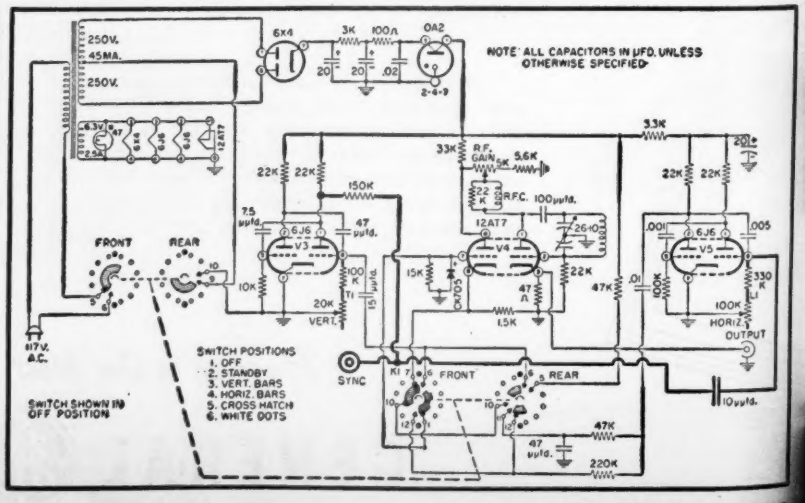

Fig. 1. Schematic of LP-1 generator with changes for improving performance. See text.

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High Voltage AC	No Isolation 90-140 volts	20 amps 2000 watts	10 amps 1000 watt
High Voltage AC	Model 713 with Isolation 90-140 volts		3 amps 300 watts
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(*Continued from page* 39)

plifier which drives a d.c. motor controlling the pitch of the propeller. If the propeller slows down because of excessive load, the automatic control decreases the pitch angle of the propeller. As the pitch angle is decreased the propeller takes less of a bite into the air and speeds up. The reverse happens if the propeller meets a lighter load, as in a dive, and speeds up excessively. In this way a constant load is presented to the power plant of the aircraft. It follows the old principle of impedance matching to obtain maximum transfer of power. We in electronics should be very familiar with this postulate.

The immediate future holds greater promise of more and more electronics for the light plane. To be released soon by one manufacturer is a v.h.f. transceiver with literally hundreds of channels for simplex transmission and reception. *Tacan* and weather radar may soon become popular in this field and the apparent goal is completely automatic control from parking place on the ramp, into the air, and back again. We have touched briefly upon some of the more important uses of electronics in small aircraft to give you an idea of the vast range of devices and circuits available. Nearly every aspect of electronic science is touched upon in one way or another.

Because of the critical nature of aircraft equipment, such gear must meet the highest engineering standards. So, too, the men who service and maintain this equipment must be ready to meet the challenge of advanced design and be prepared to learn the new concepts of electronic applications that are so rapidly finding their place in small aircraft.

Take a trip out to your municipal airport and look around. Ask the technicians there about their equipment. If you can see the unlimited possibilities for the future, all you need is a radiotelephone license, second class, and the courage to challenge new frontiers. —30—

BUILT-IN SCOPE VOLTAGE CALIBRATOR

By J. E. STRENK

MOST service type oscilloscopes do not have a calibrated, built-in, variable, peak-to-peak voltage source available for more accurate waveshape analysis.

To provide a source variable from 0 to 100 volts peak-to-peak, a resistor in series with a 100,000 ohm pot, as shown in the diagram, was installed in an early Model O-7 Heath oscilloscope. By use of the formula, (2.8 E_{rms})—100 = R, a value R, in kilohms, can be found for any convenient voltage in any oscilloscope as measured with an ordinary a.c. voltmeter. Note that the 100,000 ohm pot was purposely chosen to simplify the calculation of R for any voltage, E. Also, it provides minimum loading on the power transformer.

In the Heath O-7 oscilloscope used by the author, 330 volts r. m. s. was measured from one side of the power transformer secondary to ground. Calculating: (2.8 x 330)—100 = 824,000 ohms. The nearest RETMA value (820,000 ohms) was used for R. The potentiometer was mounted in a convenient place on the front panel approximately 2¾" above the "Sweep Gen.-Hor. Input" switch. The center arm of the pot was brought out to the binding post on the front panel marked "60 Cycle Test" after first having removed the filament voltage connected to it.

The easiest means of calibration (which is accurate enough for ordinary purposes) is simply to measure the voltage from the binding post to ground at 10 volt intervals using an ordinary a.c. voltmeter, remembering of course to divide each peak-to-peak reading by 2.8. Voltage markings should be recorded either directly on the panel or on a paper template glued to the panel. Acrylic plastic spray will protect the calibration marks.

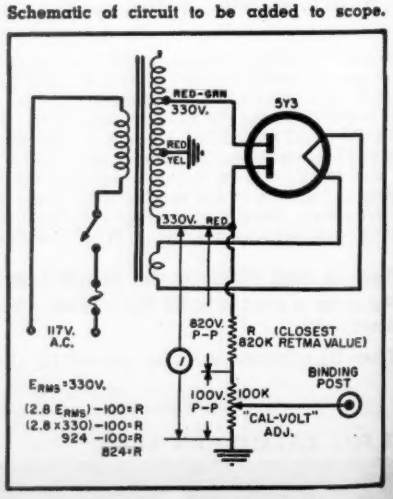
To use the calibrator, the operator merely touches the probe tip to the newly labeled "Cal.-Volt" binding post which is hot all the time. The 100,000 ohm pot labeled "Cal.-Volt.-Adj." is set for any desired peak-to-peak voltage and the vertical gain control set for a convenient scale deflection. The vertical input is now calibrated and ready for use. An alternative method is to first observe the unknown waveform, noting the amount of deflection. Then touch the probe tip to the "Cal.-Volt." binding post and set the "Cal.-Volt.-Adj." pot for the same deflection. Interpolation between 10 volt markings will be fairly linear. —30—

PEAK-TO-PEAK VOLTS	R.M.S. VOLTS
100	35.7
90	32.0
80	28.5
70	25.0
60	21.4
50	17.8
40	14.3
30	10.7
20	7.0
10	3.6
0	0

(Formula: R.M.S. = Peak-to-Peak/2.8)

Calibration data for use with circuit below.

Schematic of circuit to be added to scope.



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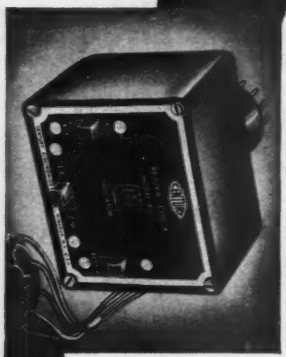

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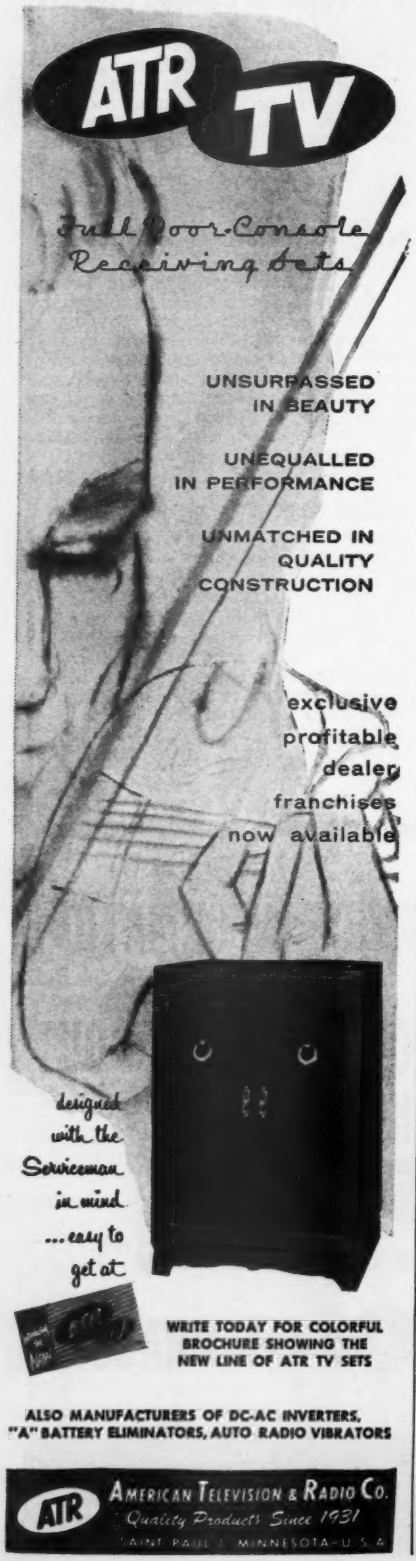
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Labor-Saving Chassis Mounting

By **HILTON L. REMLEY**

Speed your troubleshooting chores by adopting this method of installing your rack-and-panel mounted radio equipment.

IN the usual rack and panel mounting system that is in common use by most constructors, with the standard chassis mounted at right angles to the panel, strengthened in some cases by brackets which are bolted to both the chassis and the panel, servicing is certainly not very convenient without removing units from the rack. This removal also means that we must disconnect the equipment from the external circuit, resulting in the use of jumper wires if the equipment is to be serviced after removal yet kept in the circuit.

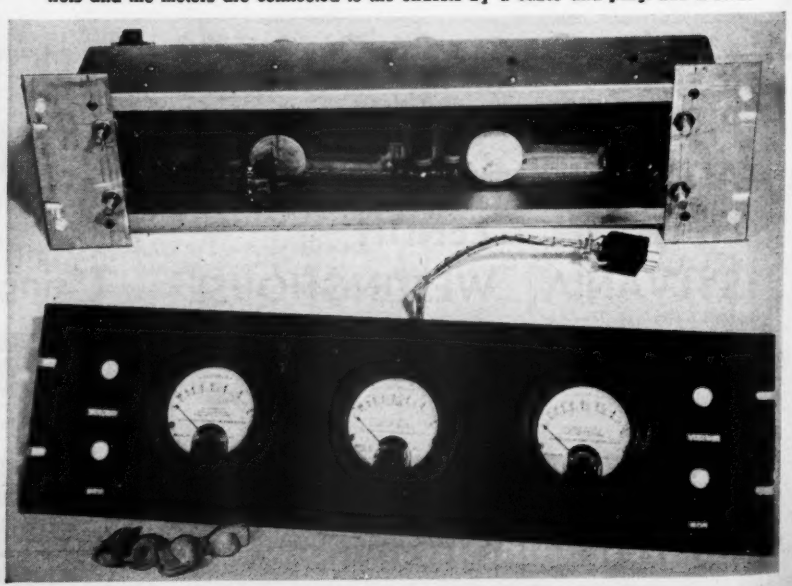
A number of us in the commercial field have noted during the past few years, two systems in use by a number of the equipment manufacturers, whereby a unit may be serviced without removal from the rack or disconnection from the circuit.

One of these systems involves the hinging of the usual chassis-type panel near the bottom, thus allowing the entire unit to be "folded out" of the rack. The other system was to bolt the chassis, with the underside facing forward, directly to the rack instead of the panel. The panel was then bolted to the rack entirely separate from the chassis. Thus, removal of the panel does not disturb the equipment and yet all wiring is at once exposed in a position such that it may be serviced, right in the rack.

This latter system may be incorporated by the average constructor, as shown in the photo. Note that any standard chassis that does not exceed the rack clearance of 17 inches wide can be used. The only additions are two pieces of sheet metal, aluminum, or steel (an old panel works well) mounted on either end of the chassis, as shown. Both of these pieces have notches cut in them, corresponding to those in the panel. The chassis is then mounted in the rack with flathead screws, countersunk flush with the surface. All controls are mounted directly on the chassis itself, rather than on the panel, by means of mounting strips or brackets. The panel is then drilled to allow shafts, etc., to project through the panel. Even dial lights may be mounted on the chassis, if desired.

In one case, the meters were mounted directly to the panel only because a standard, three-hole meter panel was available in the junk box. This construction involved the use of a cord and plug arrangement. Even meters may, however, be mounted on the chassis, corresponding holes cut in the panel to line up with the meters when it is mounted on the rack. Note that the panel will be raised above the rack surface by a distance equal to that of the two brackets used. If this type of construction is used throughout the system, then all panels will be flush. It not, then washers or spacers must be used to raise other panels to the same height from the rack in order to make the panels flush. -30-

Photo shows the notched mounting brackets installed on each end of chassis, with the controls incorporated on these brackets. The panel has holes cut for these controls and the meters are connected to the chassis by a cable and plug. See article.



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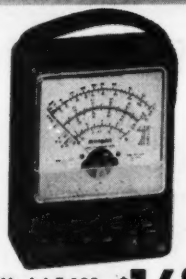

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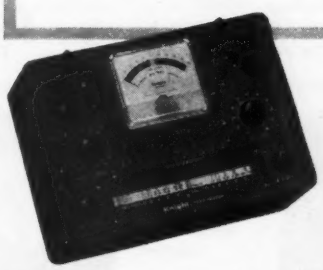
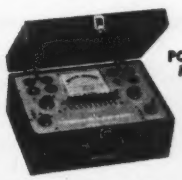
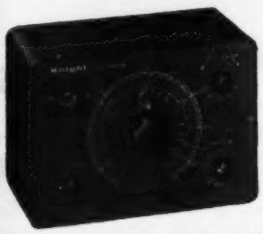
F-126. Hi-Voltage Probe; extends DC to 50,000 Volts **$4.75**
F-127. Hi-Frequency Probe; extends AC to 250 mc.. **$3.45**





PORTABLE MODEL



knight-kit RESISTOR-CAPACITOR TESTER KIT

Model F-124 **$19.50**

Measures capacitance and resistance by accurate bridge method; checks for opens and shorts in paper, mica and ceramic capacitors; shows power factor of electrolytics. Large dial shows capacitance and resistance at a glance; balanced-bridge circuit with "magic eye" null indicator measures power factor from 0-50%. Tests capacitors with rated voltages applied. 5 test voltages: 50, 150, 250, 350, 450. Capacity ranges: 10 mmf to 1000 mfd in 5 ranges. Resistance ranges: 100 to 50,000 ohms and 10,000 ohms to 5 megs. Accuracy, ±10%. Automatic discharge feature prevents after-test shock. Blue-finished steel case, 5 x 3 x 2". With tubes and all parts. Shpg. wt., 8 lbs.

Model F-124. Resistor-Capacitor Tester Kit. Net only..... **$19.50**

Model F-143 **$29.75**

knight-kit LOW-COST TUBE TESTER KIT

Offers high accuracy, top versatility and convenience at lowest cost. Tests 4, 5, 6 and 7-pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. *Features test for new 600 ma series string tubes.* Tests for open, short, leakage, heater continuity and quality (by amount of cathode emission). 4½" square meter with clear "GOOD-?-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 14 filament voltages from .63 to 117 volts. Blank socket for future type tubes. Universal-type selector switches for any combination of pin connections. *Single-unit, 10-lever function switch.* Entire switch assembly is installed as a single unit—saves time and greatly simplifies construction. Illuminated roll chart lists over 600 tube types. Shpg. wt., 14 lbs.

Model F-143. Counter Model Tube Tester Kit. Net only... **$29.75**
Model F-142. Portable Model Tube Tester Kit. Net only.... **$34.75**
F-141. TV Picture Tube Adapter for above. Net only..... **$3.75**

NEW knight-kit TRANSISTOR & DIODE CHECKER KIT

Model F-149 **$8.50**

Checks leakage-to-gain ratio and noise level of all junction, point contact and barrier transistors. Also checks diodes, forward and reverse current conduction of selenium rectifiers; useful for continuity and short checks. Easy-to-read meter. Features: spring-return leakage gain switch; calibration control; separate sockets for PNP and NPN transistors. Headphones or signal tracer may be used with checker for noise measurements. Case, 5 x 3 x 2". With 22½ volt battery. 2½ lbs.

Model F-149. Transistor Checker Kit. Net. **$8.50**

Model F-119 **$12.50**

knight-kit LOW-COST "IN-CIRCUIT" CAPACITOR CHECKER KIT

Tests capacitors while they are still wired in the circuit! Saves time and bother; an essential instrument for the service technician. Just press a button and the "magic eye" instantly shows opens and shorts (not leakage). Tests opens and shorts on any capacitor of 20 mmf or greater capacity, even if it is in parallel with a resistance as low as 50 ohms. Tests for shorts may be made on any capacitor even when it is shunted by as low as 20 ohms. Blue-finish steel case, 7¾ x 5¼ x 5". With tubes, all parts, wire and solder. Easy to assemble. Shpg. wt., 5 lbs.

Model F-119. Cap. Checker Kit.... **$12.50**

EASY PAYMENT TERMS: If your total KNIGHT-KIT order is over $45, take advantage of our liberal Time Payment Plan —only 10% down. Write for application blank.

ALL PRICES NET F.O.B. CHICAGO

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ALLIED'S own MONEY-SAVING knight-kits

FAMOUS knight-kits FOR HOBBYISTS & EXPERIMENTERS...FASCINATING, INSTRUCTIVE...

knight-kit
"SPACE SPANNER" BAND SWITCHING RECEIVER KIT

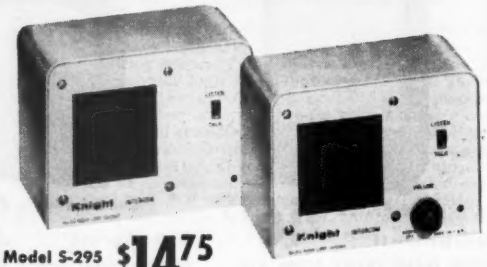
Model S-243 **$15.95**

Thrilling Short Wave and Broadcast

Famous 2-band AC-DC receiver in easy-to-build kit form at a very low price. Pulls in thrilling short-wave (6 to 17 mc) and standard broadcast. It's fun listening to amateur, aircraft, police and marine radio. Features highly sensitive regenerative circuit. Bandswitch selects broadcast or short wave. Has 4" PM speaker and beam-power output tube for plenty of volume; headphone connectors for weak signal listening; slide switch cuts out speaker. Uses 12AT7 regenerative detector and audio amplifier, 50C5 power output, 35W4 rectifier. Six controls: Bandspread; Main Tuning; Antenna Trimmer; Bandswitch; Regeneration; Audio Gain. Includes tubes and all parts. 7 x 10½ x 6". Shpg. wt. 4½ lbs.

Model S-243. "Space Spanner" Receiver Kit. Net only..... **$15.95**

S-247. Matching Cabinet for above. 2 lbs. Net..... **$2.90**



Model S-295 **$14.75**

NEW knight-kit TWO-WAY INTERCOM KIT

New low-cost, easy to build intercom system kit. Ideal for use in home or office. Consists of Master unit and Remote unit, each with press-to-talk switch. Remote unit may be left "open" for answering calls from a distance, for "baby-sitting", etc. Remote may also be connected for "private" operation—cannot be "listened-in" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier; each unit has 4" PM dynamic speaker. Complete with Antique White cabinets (4¾ x 6½ x 4¾"), all parts, tubes and 50 feet of cable (up to 200 feet of cable can be added). For AC or DC. Shpg. wt., 7 lbs.

Model S-295. Two-Way Intercom Kit. Net only.. **$14.75**

Model S-740 **$11.75**

knight-kit
"OCEAN HOPPER" RECEIVER KIT

Tops for exciting broadcast, long wave and short wave reception. Highly sensitive regenerative-type circuit. Excellent headphone reception; can be used with 3-4 ohm PM speaker on strong broadcast band stations. Supplied with plug-in coil for standard broadcast; covers long wave and popular short wave bands with coils below. Pulls in thrilling foreign broadcasts, police, amateurs and aircraft. Controls: Main Tuning, Bandspread, Antenna Tuning. Off-On-Regeneration. With all parts and tubes (less extra coils and headset). AC or DC. Shpg. wt., 5 lbs.

Model S-740. "Ocean Hopper" Kit..... **$11.75**

EXTRA PLUG-IN COILS

S-741. Long Wave, 155-470 kc. Net..... 79¢
S-742. Short Wave, 1.65-470 kc.
S-743. Short Wave, 2.9-7.3 mc. } Net each..... 65¢
S-745. Short Wave, 7-17.5 mc.
S-744. Short Wave, 15.5-35 mc.

Model S-735 **$17.25**

knight-kit
"RANGER II" SUPERHET RADIO KIT

Thousands have built and enjoyed the "Ranger" Broadcast Band Receiver. Carefully engineered for easy construction and powerful, sensitive performance. Latest Superhet circuit; tunes 540 to 1680 kc; covers entire broadcast band and exciting police calls. Features automatic volume control, built-in preformed loop antenna, ball-bearing tuning condenser. Develops excellent tone quality from Alnico V PM dynamic speaker. Supplied with following tubes: 12SA7GT converter; 12SK7GT IF amp.; 12SQ7GT det.-AVC-audio; 50L6GT audio output; 35Z5GT rect. Complete with handsome brown plastic cabinet (6 x 9 x 5) tubes, speaker, all parts, and instruction manual. AC or DC operation. Shpg. wt., 8 lbs.

Model S-735. "Ranger II" Superhet Radio Kit. Net only..... **$17.25**

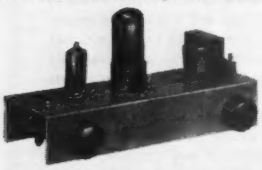
Model S-730 **$19.95**

knight-kit
3-WAY PORTABLE RADIO KIT

A low-cost portable radio covering the full standard broadcast band from 535 kc to 1650 kc. Delivers excellent reception on AC or DC current or from self-contained batteries. Sensitive Superhet circuit features automatic volume control, economical operation. Includes powerful 5" Alnico PM dynamic speaker, efficient ferrite loop-stick antenna. Supplied with following tubes: 1R5 converter; 1U4 IF amplifier; 1U5 detector-AVC-audio; 3V4 audio output. Complete with attractive portable case (7¾ x 10 x 5¼"), tubes, speaker, all parts and instruction manual. Shpg. wt., 6 lbs.

Model S-730. 3-Way Portable Radio Kit (less batteries). Net. **$19.95**

J-651. Battery Kit for above..... **$2.50**



Model S-790 **$8.95**

knight-kit LOW COST PHONO AMPLIFIER KIT

It's easy to build this fine-performing, low-cost compact phono amplifier. Ideal for use in a portable phonograph—simply add any record player and a 3 to 4-ohm speaker. Amplifier works with crystal or ceramic cartridges. Inverse feedback circuit for rich, clean tone quality. Delivers full 1½-watt output with less than .25 volt input. Includes efficient tone control; has AC outlet, controlled from amplifier switch. Complete with tubes and all parts. Size only 4½ x 7 x 4"—fits into almost any portable phono case. Shpg. wt., 3 lbs.

Model S-790. Phono Amplifier Kit. Net only..... **$8.95**

FAMOUS knight-kit CRYSTAL SET KIT

Model S-261 **$2.15**

Thousands of beginners have started in radio and electronics by building the KNIGHT-KIT crystal set. This feature-packed set delivers loud, clear reception of local broadcast stations. A germanium crystal diode detector assures high sensitivity and simple operation—no crystal adjustment required. "Hi-Q" coil boosts sensitivity. Ball-bearing variable capacitor for easy tuning. With all parts and simple-to-follow instructions. Shpg. wt., 1 lb.

Model S-261. Crystal Set Kit. Net only..... **$2.15**

S-267. Accessory Kit. 2000-ohm headphones and all parts for outdoor antenna..... **$2.95**

Buy with confidence from ALLIED — America's Pioneer in Electronic Kits

finest quality electronic equipment in lowest-cost kit form

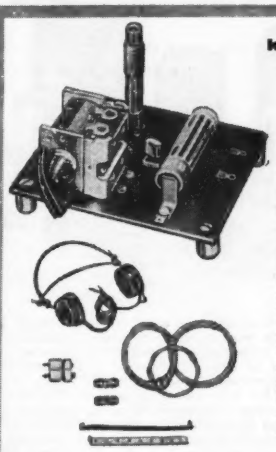
EASY-TO-BUILD HIGH PERFORMANCE KITS • WIDELY USED BY MANY LEADING TRAINING SCHOOLS

NEW knight-kit ELECTRONIC PHOTOFLASH KIT

Model S-244 **$28.50**

New feature-packed photoflash kit—designed for top quality dependability—available at a money-saving low price. Ideal for black and white or color photography. Xenon-filled reflector-bulb assembly gives over 10,000 flashes at less than ½¢ each! 1/700-second flash freezes the fastest action. Has 50 watt-second output. Provides light approximating daylight in spectral quality; permits the use of outdoor-type film indoors. Film guide number for color (ASA10) is 45. Designed for "X" or "O" shutters only. Requires sync cable (available from any photo supply dealer) and either battery or AC supply listed below. Complete outfit with battery weighs only 3½ lbs. Kit includes all parts, carrying case and easy-to-follow instructions. Shpg. wt., 3 lbs.

Model S-244. Electronic Photoflash Kit. Net.... **$28.50**
S-246. AC Power Supply Kit. Easy to assemble.... **$3.75**
J-626. Battery for above (Burgess U-200)..... **$8.47**



knight-kit TRANSISTOR RADIO KIT

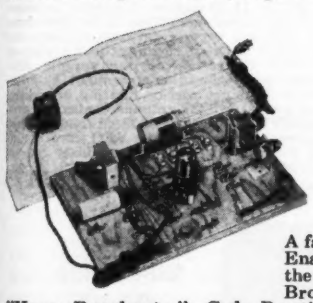
Printed Wiring • Works from Penlight Cell

Model S-765 **$4.35** **Smooth Variable Capacitor Tuning**

Experiment with the marvel of transistors! Printed circuit requires no wiring—just assemble with a few solder connections and enjoy excellent reception over the full AM broadcast band. No tubes to burn out—no crystal. Compact—fits in the palm of your hand—operates for months from a single penlight cell. Transistor provides plenty of power for strong headphone reception. Complete with all parts, transistor and penlight cell. Shpg. wt., 8 oz.

Model S-765. Transistor Radio Kit **$4.35**
S-266. Accessory Kit. 4000-ohm headphones and all parts for outdoor antenna..... **$3.15**

FAMOUS knight-kit LAB KITS

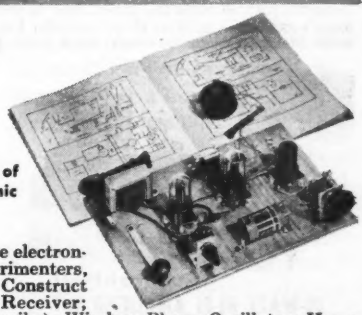


6-IN-1 RADIO LAB KIT

Model S-770 **$7.95** **Build Any of 6 Electronic Projects**

A fascinating and instructive kit. Enables you to build any one of the following projects: Standard Broadcast Receiver; Wireless "Home Broadcaster"; Code Practice Oscillator; Code Practice Broadcaster; Signal Tracer; Sine Wave Generator. Perfect for beginners. Once basic wiring is completed, circuits may be changed without soldering. Safe to build and operate; only tools needed are screwdriver, pliers and soldering iron. The ideal kit for students and beginners in electronics. Kit includes mounting board, tube, all parts and easy-to-follow instruction manual. Less headphone (also serves as mike). Shpg. wt., 6 lbs.

Model S-770. "6-in-1" Lab Kit. Net only..... **$7.95**
J-112. Single 1000-ohm headphone for above..... **$1.05**
C-100. Antenna kit for above..... **$1.05**

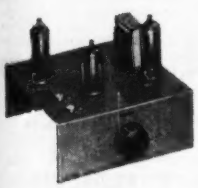


10-IN-1 LAB KIT

Model S-265 **$12.65** **Build Any of 10 Electronic Projects**

A wonderfully instructive electronics kit. Ideal for experimenters, beginners—fun to build. Construct a sensitive Broadcast Receiver; Amplifier (for phono or mike); Wireless Phono Oscillator; Home "Broadcast Station"; Code Practice Oscillator; Capacity-Operated Relay, or any one of *four* other fascinating projects. Low voltages; safe to build and operate. Only tools needed are soldering iron, screwdriver and pliers. Perfect for self-instruction in circuit fundamentals, and packed with practical applications. Kit includes mounting board, tubes, all parts, hardware, microphone, and 12-page builders' manual. Shpg. wt., 10 lbs.

Model S-265. "10-in-1" Lab Kit. Net only..... **$12.65**
J-112. Single 1000-ohm headphone for above..... **$1.05**
C-100. Antenna Kit for above..... **$1.05**

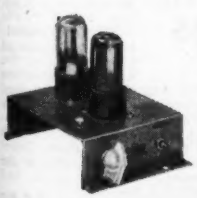


knight-kit WIRELESS BROADCASTER KIT

Model S-705 **$9.50**

This fascinating unit makes it possible to "broadcast" witn phonograph or microphone through any standard radio receiver up to 50 feet away—without any connection to the set. May be used with crystal or magnetic cartridge, or with microphone. Broadcasts a clear, full-toned signal. High-gain stage permits using magnetic cartridge without need for external preamp. Complete with all parts, tubes, wire and solder (less microphone). 4½ x 5 x 6". Easy to assemble. Shpg. wt., 3 lbs.

Model S-705. Wireless Broadcaster Kit. Net only..... **$9.50**
S-556. Microphone for above with 5-ft. cable..... **$3.95**



knight-kit PHONO OSCILLATOR KIT

Model S-760 **$5.85**

This low-cost phono oscillator may be used with any crystal phonograph for "broadcasting" recorded music through any standard radio receiver up to 50 feet away. Requires no direct connection to radio set. Operates on any frequency between 600 and 800 kc. Has controls for adjustment of modulation level and selection of clear frequency on radio receiver. Uses 50L6GT tube and 35Z5GT rectifier. Complete with all parts, tubes and instructions. 4¼ x 4¼ x 4½". Shpg. wt., 1 lb.

Model S-760. Phono Oscillator Kit. Net only..... **$5.85**

ALL PRICES NET F.O.B. CHICAGO

knight-kit CODE PRACTICE OSCILLATOR KIT

Model S-239 **$3.95** **Transistor Circuit—Powered by Penlight Cell**

An ideal code practice oscillator. Uses transistor circuit. Extremely low current consumption—powered by single penlight battery. Provides crisp, clear tone (400 to 600 cps). Has input jack for earphone; screw-type terminal strip for key. In compact bakelite case (2⅜ x 3¾ x 1½") with anodized aluminum panel. Complete with all parts, transistor, battery and easy-to-follow instructions. Shpg. wt., 1 lb.

Model S-239. Code Practice Kit.... **$3.95**

See Next Page for Amateur Kits

order from **ALLIED RADIO** 100 N. WESTERN AVE., CHICAGO 80, ILL.

ALLIED'S *own* knight-kits *give you the most for your money*

BUILD YOUR OWN QUALITY HI-FI AMPLIFIER!

knight-kit

BASIC 25-WATT LINEAR-DELUXE HI-FI AMPLIFIER KIT

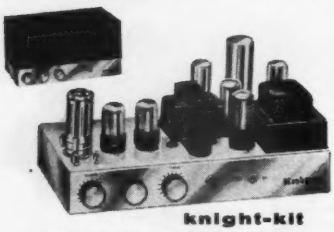
Model S-755

$44.50

Williamson-Type Circuit
Printed Circuit Board
Chrome-Plated Chassis

This super-quality hi-fi basic amplifier is designed to satisfy the most critical listener. Intended for use with tuners incorporating built-in preamp or with separate preamp. Incorporates latest Williamson-type circuit and has potted matched transformers. Delivers maximum output of 45 watts. Frequency response is: ±0.5 db. 10 cps to 120 kc, *measured at 20 watts.* Harmonic distortion is only .15% right up to 30 watts. Intermodulation distortion is only .27% at 10 watts and only .4% at 20 watts, using 60 cps and 7 kc, 1:4 ratio. Hum level is —85 db below full rated output. Output impedance, 4, 8, 16 ohms. Input voltage for 25-watt output is 1.8 volts. Uses two 12AU7's, two 5881's, and a 5V4. Etched circuit is utilized in voltage amplifier and phase inverter stages to speed assembly. Has output tube balancing control, variable damping control, and on-off switch. Handsome chrome-plated chassis, 14 x 9 x 2". Overall height, 7". A deluxe true hi-fi amplifier equal in performance to amplifiers selling at over twice the price. Complete with all parts and tubes. Easy to assemble. Shpg. wt., 27 lbs.

Model S-755. Basic 25 Watt Hi-Fi Amplifier Kit. Net only **$44.50**
S-759. Metal enclosure for above; black finish. 3 lbs. Net **$4.25**



knight-kit

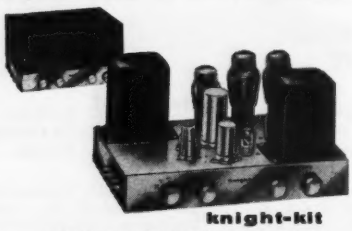
10-WATT HI-FI AMPLIFIER KIT

Model S-753 — Chrome-Plated Chassis

$23.50

Famous for wide response and smooth reproduction at low cost. Only 0.5 volt drives amplifier to full output. Frequency response: ±1 db, 30-20,000 cps at 10 watts. Harmonic distortion less than 0.5% at 10 watts. Intermod. distortion less than 1.5% at full output. Controls: on-off-volume, bass, treble. Input for crystal phono or tuner. Chromed chassis; punched to accommodate magnetic cartridge preamp. Matches 8 ohm speakers. Shpg. wt., 14 lbs.

Model S-753. Amplifier Kit. Net .. **$23.50**
Model S-235. Preamp Kit for above ... **$3.10**
S-757. Metal Enclosure. 3 lbs. **$3.95**



knight-kit

20-WATT HI-FI AMPLIFIER KIT

Model S-750 — Chrome-Plated Chassis

$35.75

True hi-fi for less! Frequency response, ±1 db, 20-20,000 cps at 20 watts. Distortion, 1% at 20 watts. Hum and noise level: tuner input, 90 db below 20 watts; phono 72 db below 20 watts. 4 inputs: magnetic phono, microphone, crystal phono or recorder, and tuner. Controls: Bass, Treble, Volume, Selector. With compensation positions for 78 and LP records. Built-in Preamp. Outputs: 4, 8, 16 and 500 ohms. 23 lbs.

Model S-750. 20-Watt Kit. Net **$35.75**
S-758. Metal Enclosure. 3 lbs. **$4.15**
S-752. Chrome-plated escutcheon for cabinet installation of amplifier. Net **$1.40**

LOW-COST TOP QUALITY KITS FOR THE HAM

knight-kit

Model S-255

$43.75

50-WATT CW TRANSMITTER KIT

Built-in Pi-Type Antenna Coupler

Check the features packed into this new transmitter kit and you'll see why it's one of the greatest Amateur values ever offered. Compact and versatile, it is the perfect low-power rig for the beginning Novice or seasoned veteran. Features: 50 watts input to 807 final; high-efficiency 6AG7 modified-Pierce oscillator takes crystal or VFO without circuit changes; bandswitching coverage of 80, 40, 20, 15, 11-10 meters; pi-section antenna output matches line impedances from 50 to 1200 ohms —permits use with any type of antenna; no separate antenna tuner required. Crisp, clean, cathode keying of oscillator and final. Power take-off plug supplies filament and B-plus voltages for other equipment. Copper-finished chassis and cabinet interior, filtering, shielding, bypassing, and coaxial SO-239 antenna connector provide excellent TVI suppression. Meter reads either plate or grid current of final. Jacks for VFO, crystal and key. Supplied with all parts and tubes. Less crystal and key. 8⅛ x 11⅛ x 8¾". Shpg. wt., 18 lbs.

Model S-255. 50-Watt Transmitter Kit. Net ... **$43.75**

knight-kit

SELF-POWERED VFO KIT

Model S-725

$28.50

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread: separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output on 80 and 40 meters. With Spot-Off-Transmit switch for "no swish" tuning. Extra switch contacts for operating relays and other equipment. With all parts and tubes. 8 lbs.

Model S-725. Self-Powered VFO Kit. Net.. **$28.50**

NEW knight-kit

AMATEUR RF "Z" BRIDGE KIT

Model S-253

$5.85

Measures standing wave ratio (SWR) and impedance of antenna systems; also for adjusting antenna networks for optimum results. Any VOM may be used for null indicator. High accuracy with 20,000 ohm/v VOM. Correction factor info supplied for other VOM's. With coax input and output connectors. Meters both input and bridge voltage. Calibrated dial gives direct impedance reading; includes 1% precision resistor for precise calibration adjustment. With all parts and handy plasticized SWR chart. 1½ lbs.

Model S-253. "Z" Bridge Kit. Net only **$5.85**

ALLIED RADIO

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Our 38th year

ALLIED RADIO CORP., Dept. 01-M-6, 100 N. Western Ave., Chicago 80, Ill.

Ship me the following KNIGHT-KITS:

Quantity	Description	Model No.	Price

$_____ enclosed. For parcel post include postage (express is shipped collect).

Name _____

Address _____

City _____ Zone _____ State _____

← order Today

INCENTIVE PROGRAM

The second phase of the *National Company's* "Bonus Bucks" incentive program for high-fidelity products will continue until December 31st of this year. Top prize to be awarded will be an all-expense "Hi-Fi Holiday in Havana." A variety of other awards will also be made, based on a point system for hi-fi units sold during the July 1st-December 31st period. Merchandise awards will include TV sets, home appliances, sporting goods, etc.

Owners and sales personnel of the company's retail outlets can compete as can the firm's sales representatives. "Bonus Bucks" credits will be issued for sales of the company's "Criterion" AM-FM stereo radio tuner, "Horizon" 10 and 20 amplifiers, "Horizon" 5 plug-in preamp, and the "Copley," "Copley Square," "Wellesley," and "Synfonette" speaker systems.

* * *

"BONDED DEALER" MATERIALS

Raytheon Manufacturing Company, Newton 58, Mass., has announced a comprehensive "Bonded Dealer" advertising and promotion campaign for 1956-57. According to the company, this new business-building program is the most complete and comprehensive ever offered by the firm.

Included in the program is a group of specially designed items to assist the company's "Bonded Dealers" in the

efficient operation of their businesses. Also included is a collection of proven business builders and shop aids to assist dealers in stimulating customer interest and confidence. Among the many colorful and attention-getting display cards and streamers is the newly designed "Bonded Dealer Creed" which colorfully and effectively carries the Code of Ethics subscribed to by such dealers.

The campaign will also include consumer advertising and local tie-in promotions.

* * *

"MAKE WAY FOR COLOR"

A new dealer-aid, to assist distributors and dealers in selling and servicing color television is being offered by *Sylvania Electric Products Inc.*

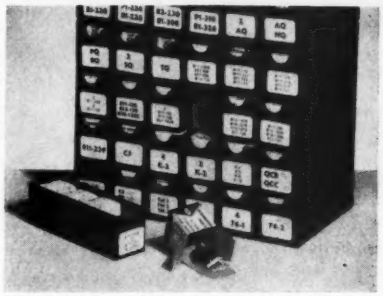
The new item is a 10-minute film strip entitled "Make Way for Color." The color film and recorded narrative points up selling reasons and outlines the major differences in the composition of black-and-white and color TV sets. It also touches on some of the new terms added to the technical vocabulary as a result of the impact of color TV.

The film may be requested for distributor or dealer meetings by contacting local electronic products sales representatives of the company.

* * *

IRC SELLING PROGRAM

International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa., has set up a double-barreled selling program



which is designed to increase dealer sales on the firm's "Resist-O-Cards," parts stocks, and volume controls.

The new "Resist-O-Cards" being introduced cover virtually all values of ½, 1, and 2 watt carbon composition resistors. Standard packages include ten die-cut cards of a resistor type clearly visible from the new and attractive counter displays.

The new dealer parts stocks and the conversion stock will make possible a real bargain in volume control coverage. These stocks provide exceptionally wide coverage of 809 different carbon and wire "exact duplicate controls" and standard single controls.

These new sales aids are now available at all territorial sales offices and from representatives of the company or may be ordered from the manufacturer direct.

* * *

FUZE-TYPE RESISTOR CARDS

Clarostat Mfg. Co., Inc., of Dover, N. H., is now packaging its new plug-in fuze-type resistors of 5.6 ohms on a special wall display card.

Twelve of the new units are packaged and mounted on a "Fuzohm Card," GL-2. The company is also offering the GL-1 card, which mounts twelve of its 7.5 ohm units.

Write the company for full information on the product and the display.

* * *

CLOSED-CIRCUIT TV

General Electric Company's Broadcast Equipment Section and Apparatus Sales Division have started an intensive campaign to promote the sale of closed-circuit television systems.

In addition to a series of nationwide sales meetings, the company will implement the campaign by tie-in advertising for "Intratel." The original promotion will be aimed at the industrial,

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City..... State.....

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MDF-82 for exact replacement in over **30 DUMONT** models and chassis; equipped with octal plug and ground clamp. Another in the complete line of exact transformers, yokes and coils. Merit is the only manufacturer of transformers, yokes and coils who has complete production facilities for all parts sold under their brand name.

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transportation, aviation, and defense fields with emphasis on commercial and business applications and the institutional, educational, and municipal fields next year.

* * *

GIANT SPEAKER

High Fidelity Associates of Miami, Fla., is not reticent about announcing its business and the products it distributes.

A ten foot steel and aluminum replica of an *Electro-Voice* loudspeaker rotates atop the company's building, attracting favorable attention to the store and its products.

* * *

HOTPOINT TV

Hotpoint Co., 5600 W. Taylor St., Chicago 44, Ill., is slanting the advertising on its new TV line to the theme of "family enjoyment" rather than the technical aspects of receiver circuitry, etc.

* * *

CHRISTMAS IGLOO

The Radio and Television Division of *Sylvania Electric Products Inc.* has announced an exclusive Christmas promotion with premiums for consumers and prizes for television dealers.

The promotion has its focal point in the "Igloo," a unique playhouse modeled after the real thing. The igloo is made of durable cardboard and is easily assembled. It is topped by a TV antenna. The toy is given free to consumers with the purchase of one of the company's television receivers during the Christmas shopping season.

A window display contest, using the "Igloo" as a theme, will enable dealers to cash in on the increased sales. Prizes will be awarded on the basis of photographs of dealer displays submitted before January 15th. Winners will be announced in March.

* * *

E-V "ROAD SHOW"

Electro-Voice, Inc., of Buchanan, Mich., has taken five tons and $20,000 worth of hi-fi equipment on a tour scheduled to last until May of next year.

Employing a *Wells Cargo* carrier and two panel trucks, the "road show" will display speaker enclosures, "do-it-yourself" speaker enclosure kits, speakers, amplifiers, tuners, complete systems, and components.

For information on the tour route and details on scheduling visits, write to Howard Souther, marketing director of the firm.

* * *

DISPLAY STANDS

Arlington Aluminum Company, 19011 W. Davison, Detroit 23, Mich., is now offering an extensive line of point-of-purchase display stands, including the company's unique "triangular" model which features three hole-board panels with aluminum trim and tubular aluminum legs. This particular model is designed to be used for displaying the product alone or with literature or bulletins included.

A free, 4-page, 2-color brochure includes information on a versatile display board used for product literature in conjunction with merchandise as well as describing the custom service offered by the company in the fabrication of specialized displays of steel, Masonite, and aluminum. —30—

MR. ELECTRONICS MAN:

If you're willing to lose your job tomorrow to a technically-trained man, *don't read this!*

But, if you're interested in an honest-to-goodness career in the vigorous young electronics industry, here's how you can step ahead of competition, move up to a better job, earn more money, and be sure of holding your technical job even if the brass is firing instead of hiring.

The "how" is CREI training in radio-television-electronics. You don't have to be a college graduate. You *do* have to be willing to study—at home. You can do it while holding down a full-time job. Thousands have. However, you must have some prior electronic experience, either in military service, professional employment, experimenting, or ham operating. Since 1927 CREI has provided alert young men with the technical knowledge that leads to more responsibility, more job security, more money. More than a quarter century of experience qualifies CREI to train you.

What qualifies *you* for CREI? If you have a high school education, you're off to a good start. If you have a knack for math, so much the better. If you are currently working in some phase of the electronics industry, you'll get going faster. But remember this: CREI starts with fundamentals and takes you along at your own speed. You are not held back by a class, not pushed to keep up with others who have more experience or education. You set your own pace. Your CREI instructors guide you through the lesson material and *grade* your written work personally. You master the fundamentals, then get into more advanced phases of electronics engineering principles and practice. Finally you may elect training at career level in highly specialized applications of radio or television engineering or aeronautical radio.

How good is CREI training? Here are a few ways to judge. Ask an electronics engineer, if you know one. Ask a high-school or college physics teacher. Ask a radio station engineer. Check up on our professional reputation: CREI home study courses are accredited by the Engineers' Council for Professional Development; CREI is an approved member of the National Council of Technical Schools. Ask personnel managers how they regard a man with a CREI "ticket." Look at this partial listing of organizations *that pay CREI* to train their own personnel: United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., Glenn L. Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair Ltd., Federal Electric Corp. and U. S. Information Agency (Voice of America). Finally, ask a CREI graduate to tell you about our Placement Bureau, which currently has on file more requests for trained men than we can fill.

What's the next step? The logical one is to get more information than we can cram into one page. The coupon below, properly filled out, will bring you a fact-packed booklet called "Your Future in the New World of Electronics." It includes outlines of courses offered, a resume of career opportunities, full details about the school, and tuition details. It's free.

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- ☐ Broadcast Radio Engineering (AM, FM, TV)
- ☐ Practical Television Engineering
- ☐ Practical Aeronautical Electronic Engineering

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TYPE OF PRESENT WORK.....

SCHOOL BACKGROUND.....

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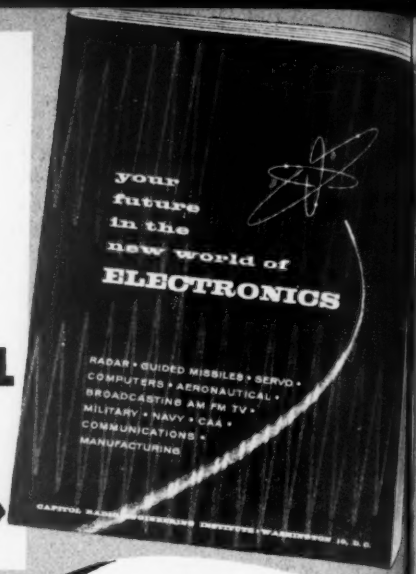

YOU CAN PLOD ALONG for years, getting paltry increases, enjoying little security, finding your work dull and drab.

Then something happens. Things look up. Your earnings rise.

"Luck," some may say. "Contacts," others may suggest.

But in your heart, you will know the answer: "Training." And it all may have started the moment you sent for a free booklet, "Your Future in the New World of Electronics." This booklet tells you where you stand in Electronics.

Tremendous expansion leaves this gigantic industry pleading for trained men. Top manufacturers sold billions of dollars worth of electronic merchandise in 1955. By 1960, the radio-electronics industry should do no less than 15 billion dollars per year, not counting military orders.

Today, there are over 132,000,000 radios in use. There are 38,000,000 TV sets and 477 TV stations in operation. Color TV is coming into high gear. Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. To fill these posts, trained men are needed—men who somewhere along the line take time to improve their knowledge, their skills. Men who, today, perhaps, take two minutes to send for a booklet.

"Your Future in the New World of Electronics" shows how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, CREI does not promise you a "snap." With an accredited technical course such as this, you must *study* to convert your ambition into technical knowledge you can sell in the fabulous Electronics market.

Since 1927, CREI has provided thousands of professional electronics men with technical educations. During World War II CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics, among them United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., Glenn L. Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair Ltd., Federal Electric Corp. and U. S. Information Agency (Voice of America).

CREI courses are prepared by recognized experts, in a practical, easily understood manner. You get the benefit of time-tested study assignments, of personal supervision of a CREI Staff Instructor who *knows* and *teaches* you what industry wants. You learn on your own time, during hours selected by you. This complete training is the reason graduates find CREI diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms. CREI's Placement Bureau finds better positions for advanced students and graduates. Although CREI does not guarantee jobs, requests for personnel far exceed current supply.

Now is the time of decision. Luck will not propel you forward unless it finds you trained. Contacts won't budge you an inch unless you have the skill to back them up. The answer is: Technical Training . . . and willingness to learn. Together they will bring you increased earnings in this new Age of Electronics. Fill out the postage-free reply card and mail it now. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—your future—is up to you.

Brand New Edition Now Available

Brings you completely up to date—answers important questions on newest career developments in Electronics—including Radar, Guided Missiles, Servomechanisms, Computers, as well as Aeronautical Electronics, Broadcasting (AM, FM, TV), Military, Navy and CAA Electronics, Communications and Electronics Manufacturing.

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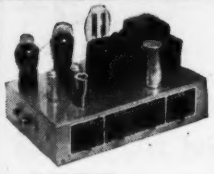
ECONOMY 20 WATT AMPLIFIER $22.95



Model HF-20

NEW 1957 MODEL

Push-Pull 6L6 Output Tubes
Response 30-15,000 CPS
Bass and Treble Tone Controls
Input for Xtal or Dynamic Mike
Input for Xtal or V.R. Phono

With CU-14Y, 12" Coax Speaker...$32.95
With P15-CR, 15" Coax Speaker...$42.95
With Imperial IV System.....$39.95
With Imperial VI.....$48.95
With HF-33GE $69.95

A tremendous High Fidelity amplifier value. Response 30 to 15,000 cps. Electronic bass and treble boost by separate tone controls. Use this amplifier with any record changer having crystal or variable reluctance cartridge, radio tuner or high impedance crystal or dynamic microphone. 20 watts power output. Use with any 4 or 8 ohm speaker or 250 ohm line. Chassis size, 7¾" x 10½" x 7½" high. Complete with tubes: 2—6L6, 2—6C4, 12AX7 and 5U4G. This is a terrific value. A ready to use high fidelity amplifier at less than the cost of a kit. Ship. wt. 17 lbs. Model HF-20, 20 watt Hi-Fi amplifier. McGee's sale price, $22.95.

LOW-BOY 3-WAY HI-FI SPEAKER SYSTEM

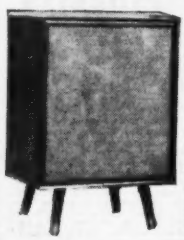
for apartment size Hi-Fidelity. Available in blond or mahogany finish. Extra value made possible by our use of new TV cabinets. Converted into Hi-Fi speaker baffle with enclosed back. All dimensions may vary slightly. Approximately 19" high plus 8" legs. Over-all height 27", 19¼" deep and 23⅛" wide. Equipped with 15" coaxial speaker and a 6" mid-range speaker on one side for augmented mid-range dispersion.

SALE PRICE **$29.95**

Stock # GM-416 Mahogany Finish Stock # GB-416 Blond Finish

3 - 1957 MODEL Hi-Fi SPEAKERS

- COMPLETE SYSTEMS WITH 4 SPEAKERS
- ACOUSTICALLY LINED ENCLOSURES



The new 1957 Hollywood, 4 speaker high fidelity speaker systems are expressly designed to give realistic reproduction from your Hi-Fi amplifier or FM-AM radio. Juke box bass response with brilliant, middle and high range response. All 3 models have genuine L-C crossover networks and variable brilliance controls. Only 2 wires to connect to the 4 or 8 ohm tap on your Hi-Fi amplifier. A fine speaker system to use with our Imperial 20, 30 and 34 high fidelity amplifiers, and all FM-AM chassis in our Radio & TV News offerings. Adjusting the twin tone controls on our Imperial amplifiers along with the brilliance control on the Hollywood speaker systems you can have fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. Choice of either blond or mahogany finishes. Baffles are fully enclosed and acoustically lined. Small enough in size for the average room, yet large enough for proper baffling. 35" high, 19" front to back, 25" wide. Specify cabinet finish when ordering, otherwise we will ship mahogany finish. Take $3.00 discount when order with any of the Imperial amplifiers or Espey FM-AM chassis offered in this 3 page ad.

Model H-4H, Hollywood 4 speaker high fidelity speaker system. 20 watts, response 30 to 17,500 cps. Choice of blond or mahogany finish enclosure. Features a 12" General Electric 6.8 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance L-C crossover network. Model H-4H. Ship. wt. 58 lbs. Price $39.95. **$39.95**

Model Y-4Y, Hollywood 4 speaker, high fidelity speaker system. 25 watts, response from 20 to 17,500 cps. Choice of blond or mahogany finish enclosure. Features a 12" General Electric 14 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance L-C crossover network. Model Y-4Y. Ship. wt. 58 lbs. Sale price, $44.95. **$44.95**

Model Z-4Z, Hollywood 4 speaker, high fidelity speaker system. 25 watts, response from 18 to 17,500 cps. Choice of blond or mahogany finish enclosure. Features a 15" 21½ oz. Alnico V Utah heavy duty woofer, plus 6" mid-range and 3-5" tweeters. Built/in variable brilliance, L-C crossover network. Model Z-4Z, Ship. wt. 57 lbs. Sale price, $49.95. **$49.95**

McGEE'S NEW 1957 MODEL

25 WATT 12" COAXIAL SPEAKER

- ★ 14½ oz. G.E. 12" WOOFER—
- ★ 3½" COAXIALLY SUSPENDED TWEETER—
- ★ BUILT-IN CROSSOVER—
- ★ ALUMINUM VOICE COIL WOOFER—

$18.95

McGee's new 1957 model, GE-120XT, 12" 25 watt high fidelity coaxial PM speaker. No frills or dummy pot cover, it's all speaker value. Features a General Electric 12", 14½ oz. Alnico V woofer with aluminum voice coil and exponential, molded seamless cone. The tweeter is of specially made 3.4" Alnico V, 3½ oz. speaker which extends the high frequency response to 17,500 cps. It is electrically connected to accept only the upper register of audio. Only two wires connect this complete high fidelity speaker to any 8 ohm amplifier. Ship. wt. 8 lbs. Stock No. GE-120XT. McGee Sale price, $18.95.

McGee's Famous

12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

$12.95 12-inch Model CU-14Y

$23.95 15-inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR. McGee's Sale Price, $23.95.

McGee's new 15" Junior coaxial PM speaker. 15" woofer has 6.8 oz. Alnico V magnet. 5" coaxially suspended tweeter with crossover. Only two wires to connect to any 8 ohm radio or amplifier. Frequency response from 40 to 19,000 cps. Model No. M15-CR, 15" Junior coax PM speaker, Sale price, $16.95.

IMPERIAL 30 WATT AMPLIFIER $29.95

NEW 1957 MODEL

Push-Pull 6L6 Output Tubes
Response 15-20,000 CPS
Bass and Treble Tone Controls
Compensated Gain for G.E. Cart.
Input for Xtal or Dynamic Mike

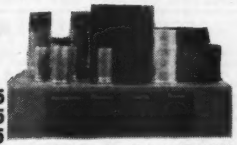
Model IMP-30

With CU-14Y, 12" Coax Speaker .$39.95
With P15-CR, 15" Coax Speaker..$49.95
With Imperial IV Speaker System .$46.95
With Imperial VI.....$55.95
With HF-33GE $76.95

New 1957 model 7 tube Imperial 30 watt High Fidelity audio amplifier. A $100.00 list value for only $29.95. Features a heavy 4 lb., specially wound high fidelity output transformer with 15% inverse feed-back; push-pull 6L6 output tubes and frequency response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. You can center your entire custom music system around this low cost 30 watt amplifier. This Imperial 30, 30 watt amplifier may be used with any radio tuner or record player. It will drive all speaker systems that you may have. Use from one to ten 8" speakers or any 12" or 15" coaxial speaker or any 3-way speaker system. Tone compensated input for either a crystal phone pickup or a General Electric variable reluctance pickup. Also, has input for crystal or high impedance dynamic microphone. 4 controls are mike gain, phono gain, treble tone and bass boost tone control. This amplifier weighs 21 lbs. net. Full size transformer components would cost you up to $15.00 if purchased separately. Gold color chassis is 12¼" x 7¾" x 7½" high. Complete with tubes: 6AT6, 12AU7, 6C4, 12AU7, 2—6L6GA, plus 5U4G rectifier. Stock No. IMP-30, 30 watt Imperial High-Fidelity amplifier complete with tubes and diagram. Ship. wt. 23 lbs., Sale price only $29.95.

NEW IMPERIAL 24 WATT AMPLIFIER $39.95

PUSH-PULL EL-34 ENGLISH MADE MULLARD OUTPUT TUBES
WILLIAMSON TYPE CIRCUIT
RESPONSE 15-20,000 CPS



With CU-14Y, 12" Coax Speaker..$40.95
With P15-CR, 15" Coax Speaker..$59.95
With Imperial IV Speaker System.$56.95
With SP12125CR..$65.95. With HF-33GE..$86.95. Model IMP-34X

New, 1957 model Imperial 34X, 24 watt high fidelity amplifier for the audio enthusiast who want McGee's finest amplifier. This amplifier features push-pull EL-34 English made Mullard output tubes in a Williamson circuit. Heavy duty 6 lb, specially wound Williamson type ultra-linear output transformer in potted case has a response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. Amplifier has input for crystal pickup and built-in pre-amplifier for the popular General Electric and Goldring variable reluctance cartridges; as well as input for crystal or high impedance dynamic microphones. 4 controls are microphone gain, phono gain and separate variable treble and base boost tone control with off-on switch. Chassis size: 12¼" x 7¾" x 7½" high. Complete with 7 tubes and diagram. Model IMP-34X, 24 watt high fidelity amplifier, ideal for use with any of our high fidelity coaxial or multiple speaker systems. Ship. wt. 26 lbs. Sale price, $39.95.

NEW IMPERIAL SPEAKER SYSTEMS

Imperial IV with 8" G.E. High Fidelity Speaker

$19.95

3-Way Imperial VI with 12" G.E. Speaker

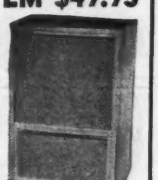
$29.95

New 1957 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 24" long. Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The IMPERIAL IV contains a General Electric Model 850 or 9770 Noreico 8" extended range high fidelity 8" PM speaker with 6.8 oz. Alnico V magnet and curvilinear cone with 8 ohm voice coil and a 5" tweeter. Response 50 to 15,000 cps. Model IV Imperial $19.95.

1957 Model Imperial VI, 3-way speaker system. Baffle is of heavy wood, leatherette covered. Similar in appearance to the Imperial IV pictured above, except 4" taller and 1" deeper. Equipped with 3 matched speakers. A 12" G.E. Model 1203 with 9 oz. Alnico V magnet, plus $14.95 for mid-range and 3" tweeter. Simple to connect to any high fidelity amplifier. (8 ohms impedance). Stock No. IMP-VI, Sale price, $29.95. Ideal for use with HF-20 and IMP-30 amplifiers described above.

CONSOLE HI-FI SPEAKER SYSTEM $49.95

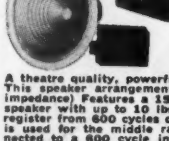
12" G.E. PM WOOFER—10" PM MID-RANGE—8" G.E. MODEL 850 MID-HIGH RANGE SPEAKER AND 600 CYCLE L-C CROSSOVER NETWORK.



Have Juke Box tone quality in your own home. Strictly High fidelity. Three speakers all connected to a 600 cycle frequency dividing network, so that only 2 wires feed the system from any 4 or 8 ohm radio or amplifier. A variable tone compensating control incorporated in the circuit makes brilliant highs or boomy lows to your own taste. Any amplifier that you now have will give you a much wider selection of acoustical arrangements with this speaker system. The 3-way system is shipped ready to connect to your amplifier or hi-fi radio. Equipped with a General Electric 12" woofer, an 8" famous G.E. 850 plus a 10" middle range speaker. Frequency response 30 to 15,000 cps. Take your choice of cabinets: blonde or mahogany. (Specify finish desired when ordering) 37" high, 24" wide and 20" deep. Ship. wt. 75 lbs. Stock No. HF-33GE. Sale price, $49.95.

Model HF-44GE, console speaker system, same as above except has a heavy duty 12" G.E. PM Model 1201, plus 8" G.E. PM Model 850, 10" mid-range speaker and 5" hard cone tweeter. Sale price, $54.95. (Specify cabinet finish.)

Model HF-55GE, super deluxe quality console speaker system, same as HF-33GE described above, except has 15", 21 oz. Alnico V magnet woofer, 10" mid-range PM speaker and Model 4401 University horn type tweeter. All 3 systems incorporate 600 cycle L-C type crossover network with variable tone compensating control. Model HF-55GE, Sale price $69.95 (specify cabinet finish).



THEATER QUALITY HIGH FIDELITY SPEAKER SYSTEM $39.95

15" WOOFER PLUS—ELECTROVOICE MODEL 847 MID-HIGH RANGE SPEAKER — 600 CYCLE LC CROSSOVER.

A theatre quality, powerful speaker system for homes and sound demonstration rooms. This speaker arrangement will connect to any high fidelity audio amplifier (8 ohms impedance) Features a 15" electro-dynamic heavy duty woofer which is equal to a PM speaker with up to 10 lbs. of Alnico V magnet. This woofer reproduces the low audio register from 600 cycles down to 20 cps. An Electro-Voice Model 847 horn type speaker is used for the middle range and high range of audio. These two speakers are connected to a 600 cycle inductive-capacity crossover network. Built in the network is the field exciter for the 15" woofer. You could spend over $100 for a speaker system and not beat this one. Stock No. EV-15847X, McGee's sale price, $39.95.

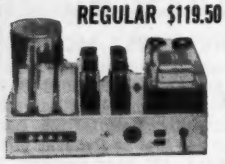
McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

McGEE's $100,000 SALE! FM/AM CHASSIS-CHANGERS— MONEY-SAVING VALUES

FM/AM TUNER
ESPEY 14-TUBE MODEL 700G



ESPEY 24 WATT
MODEL 501G AMPLIFIER

REGULAR $119.50 VALUE

ESPEY 14 TUBE FM/AM TUNER ON SALE $79.95

24 WATT HIGH FI AMPLIFIER $39.95 EXTRA

34 WATT HIGH FI AMPLIFIER $54.95 EXTRA

McGEE'S FINEST VALUE EVER OFFERED

YOU COULD SPEND MORE But Get NO BETTER

McGee offers you for only $79.95 Espey's regular $119.50 14 tube Deluxe AM-FM tuner. (Separate audio amplifier required such as model 501G or 501E.) Prices above with 14 tubes including rectifiers. Tuner has its own built-in AC power supply. Your savings are almost $40.00. Espey Model 700G performance features: Sensitivity 3mv on AM, 5mv on FM for 30db quieting. AM selectivity 10kc at 6db. FM 240kc at 6 db. Audio response flat from 20 cps. to 20,000 cps. with less than ¼ percent distortion with one volt audio output. Chassis is 14" long, 8½" high and 10" deep. Features a one-piece molded, gold-colored, plastic front which makes custom installation easy. Features full tuner RF stages—AFC on FM with defeating switch for easy FM tuning. Built-in pre-amplifier for GE variable reluctance phono cartridge. Pickering, etc. Three-position equalizer switch for—LP, AES or European phonograph records. Separate bass and treble tone controls with 23db. boost. Chassis is equipped with AC outlet jacks, auxiliary input jacks for tape recorder, etc. Built-in ferrite loop antenna for AM broadcast and 300-ohm input for FM band.
The Espey 700G FM/AM tuner is second to none. It has all the features you might expect even if you paid up to $200.00 for a tuner.
This 700G FM/AM tuner chassis has all controls on the front which is desirable when you are using it with any good audio amplifier many of which are designed with no tone control or preamplifier circuits. We offer the 700G FM/AM tuner at only $79.95. Shipping wt. 20 lbs.
Espey 700G with Model 501G 8-tube Hi-Fi audio amp. both for $119.90. Stock No. 700G-501G. Shipping wt. 42 lbs.
Espey 700G with Model 501E 8-tube 34-watt Hi-Fi power amplifier, $134.90.

Espey model 501G 8-tube ultra linear high fidelity 24 watt audio amplifier matching unit for use with model 700G tuner. Regular $79.95 value—$59.95 when purchased alone and $39.95 when ordered with the Espey 700G tuner. This amplifier features less than ½ percent distortion with high fidelity audio frequency response from 10 cps. to 20,000 cps. Hum level so low it can be detected by electrical instruments only. Chassis size—12"x5"x8". Output tubes—4 6V6GT in push-pull Williamson high fidelity. Plus 6SN7 phase inverter and 2 5V4G rectifiers. Features an eight-pound potted case $20.00 value output transformer with grain oriented iron core. Output impedance taps for 4, 8 and 16 ohms. Each **$39.95**

Espey model 501E 8-tube 34-watt ultra linear high fidelity audio amplifier companion unit to be used with the Espey 700G tuner. Same appearance as model 501G. Equipped with 4 EL 37 English Mullard output tubes. Regular $79.95 value—$69.95 if purchased separately; $54.95 if purchased with our 700G tuner. Each $54.95

ESPEY DEAL—1A

Espey 700G-501G tuner with 24 watt amplifier plus VM-956 GE 3 speed VM on metal base—1 Mill Diamond Needle $10.00 extra. Net **$144.95**

If 34 watt amp is desired in place of 24 add $15.00.

ESPEY DEAL—2

Espey 700G-501G tuner with 24 watt amplifier plus new 456 Collaro changer equipped with a GE RPX-052A cartridge. Net **$164.95**

If 34 watt amp is desired in place of 24 add $15.00.

ESPEY DEAL—3

Espey 700G-501G tuner with 24 watt amplifier plus Garrard RC-98 equipped with a GE RPX-052A cartridge. Net **$194.95**

If 34 watt amp is desired in place of 24 add $15.00.

SPEAKERS RECOMMENDED
Order any of the following speakers with your Espey tuner and amplifier:
12" coaxial PM, CU-14Y—$10.00 extra
15" coaxial PM, P15-CR—$20.00 extra
Imperial IV system—$15.00.
Imperial VI system—$25.00.
Norelco 9762—12" regularly $59.50 at $50.00 extra.
EV84—15W system—$150.00 extra.

BUY YOUR AUTOMATIC CHANGER AT McGEE

COLLARO 456 - $34.50

MONARCH UA6U - $29.95

WEBCOR ON BASE

GARRARD RC-98

4-SPEED COLLARO Latest 1957 Model RC-456, Collaro 4 speed record changer. Plays all 4 speeds, 16, 33, 45 and 78 RPM both automatically and manually. Inter-mixes records of the same speed and shuts off after last record. Fast 6 second change cycle. Automatic disengagement of idler wheels eliminates flat spots that cause wow and flutter. All of the desirable features of the Model RC-532, plus 4 speed operation. Model RC-456 Collaro 4 speed automatic record changer, less cartridge. Sale price, $34.50. RC-456 with G.E. variable reluctance cartridge with 3 mil sapphire and 1 mil diamond stylus, Sale price, $46.95. Large spindle $3.30.
Monarch Model UA6U—new, imported high fidelity 3 speed automatic record changer. Plays 7", 10" and 12" records automatically. Intermixes records of the same speed in any order. Features a 4 pole high fidelity motor eliminating rumble and wow. Pickup automatically returns to rest and motor turns off after last record has played. Full size 10" turntable has molded rubber pallet for better record cushioning. Base size, 10⅞"x12¾". Tone arm is counter balanced to assure minimum record wear. Changer features, at no added cost the regular $9.90 net value Goldring ±500 variable reluctance cartridge for the finest high fidelity record reproduction. Output 10 millivolts. Response, 20 to 16,500 cps. It requires the same gain as popular American variable reluctance cartridges. Model UA6U, Monarch automatic changer with Goldring cartridge, ship. wt. 15 lbs. Sale price, $29.95; Large spindle for 45 RPM records, $1.88 extra.
Popular Webcor changers at McGee for less money. Webcor 1642-1—popular 3-speed changer on metal base equipped with crystal cartridge. Sale price $27.95.
Webcor 1642-2I. Same as above with base as pictured except with GE RPX-050 VR cartridge. Sale price, $31.95.
New 1957 Garrard Model RC98, "crown II," 3-speed super automatic changer, one of the world's finest. Provides the greatest combination of Hi-Fi features ever found in an automatic changer. Model RC98 changer, less cartridge—$66.15. With VR cartridge, 1 mil diamond and 3 mil sapphire needles, RPX-052A—$78.15. Large 45 rpm. center spindle $3.43, extra.
Popular RC88 "Triumph" model with most of the features of the 98. RC88, less cartridge—$53.41. With RPX-052A cartridge as above—$65.41.

8" NORELCO P14 $7.95

2 for $15.00

Specially Priced at $7.95 for this ad. Norelco imported from Holland 8" Hi-Fi PM Model 9770M—fine audio reproduction from 75 cps to 19,000 cps—Imp. 4 ohms. Flux density 11,000 Gauss. Powerful Alnico Magnet. A fine addition to your Hi-Fi speaker collection.

6-TUBE, 6-VOLT AUTO RADIO WITH 6x9 SPKR. $19.99

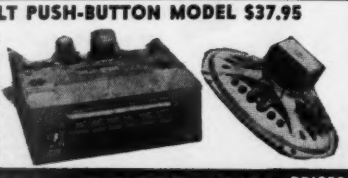
6-TUBE 12-VOLT $29.99

Six-tube, 6 volt universal mounting auto radio. Thin neat construction lends itself to a nice looking underdash installation. Some auto dash panels have room to cut out for custom installing. Speaker is not built in. Set is furnished with the popular 6x9 size. Set dimensions—9" wide, 4¼" tall, 7¼" front to back. Dial is 5½"x2½". Priced with tubes. Shipping weight, 12 lbs. Stock #AH-759. Made to sell for much more than our $19.99 price.

NEW 12-VOLT MODEL WITH SPEAKER $29.99

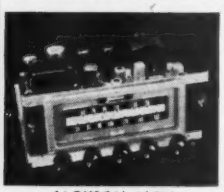
Model AH-1259, 12 volt universal mounting auto radio. This is the same set as pictured above (AH-759), except made for 12 volt model 1955 and 1956 cars. Stock No. AH-1259 with 6x9" or 5x7" speaker, $29.99.

NEW 8 TUBE 6 VOLT PUSH-BUTTON MODEL $37.95



New model SH-78555-X, 8-tube, 6-volt universal mounting auto radio with push buttons and 6x9 speaker. Made for Hudson cars, but their compact construction lends them to underdash installation. Has push-pull 6AQ5 high-powered audio. Stock No. SH78-555-X with 6x9 speaker—$37.95. With 2—5x7 speakers—$39.95; with 1—5x7 speaker $37.95. Specify speaker size wanted. Three-section top cowl mounting antenna—$2.29 extra.

9-TUBE HI-FIDELITY



JACKSON AM9A

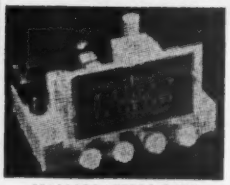
20 Watts Audio
Dual Tone Controls
Push-Pull Mullard EL 37

$39.95 LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

Jackson Model AM9A, 12 watt high fidelity audio amplifier and broadcast tuner combined, at less than you would normally pay for the amplifier alone. Push-pull EL37 output. Frequency response from 30 to 15,000 cps. Inputs for crystal or G.E.-7 variable reluctance pickup and crystal or dynamic microphone. Separate bass boost and treble tone controls. Radio-phono switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power transformer. 9½" illuminated slide rule dial with etched glass scale. 3 gang condenser with tuned R.F. stage and loop antenna. Receives broadcast 550 to 1650 kc. Size 13" long, 8" high and 9½" deep. Complete with tubes: 2-6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2-EL37 and 5Y3. Knobs, escutcheon, diagram and instructions included.
Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 9 lbs. Sale price, $39.95.
Model AM9A with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model AM9A with our P15-CR 15" coaxial PM speaker, both for $59.95.

11-TUBE FM-AM HALLICRAFTERS



HALLICRAFTERS S-78A

PLUS MONARCH RECORD CHANGER WITH RONETTE CERAMIC CARTRIDGE AND 12" COAXIAL PM SPEAKER

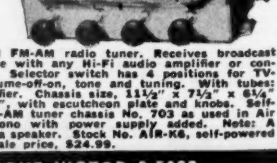
$132.40 VALUE ALL FOR **$86.95**

A COMPLETE HI-FI SYSTEM

McGee's best buy in a high fidelity home music system. You get the regular $89.50, S-78A Hallicrafters 11 tube FM-AM chassis. Monarch model UA6H, 3 speed English made record changer with Ronette super high fidelity ceramic cartridge and our CU-14Y, 12" coaxial PM speaker all for only $86.95. Hallicrafters chassis receives broadcast 540 to 1700 kc and FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches 500 ohm line as well as the 12" coax. High fidelity response 50 to 14,000 cps. Bass boost tone control. A full 11 tube transformer powered chassis with push-pull 6K6 audio. Size: 7½" x 12½" x 11" deep. Complete with tubes, knobs, escutcheon, diagram and instructions. High quality Monarch record changer plays 7", 10" and 12" records automatically. Intermixes records of the same speed in any order. Shuts off after last record has played. Features a 4 pole motor eliminating rumble and wow. Full size 10" turntable has molded rubber pallet to cushion records. Base size, 10⅞" x 12¾". Tone arm is counter balanced to assure minimum record wear. Changer features the Ronette super high fidelity ceramic cartridge with separate sapphire styli for microgroove and standard records and response to 13,500 cps. Our famous 12" coaxial PM speaker, model CU-14Y is described on the opposite page. Only two wires to connect speaker to chassis and plug pickup into phono input.
S-78A chassis, CU-14Y speaker and UA6H changer, Ship. wt. 45 lbs. All for only $86.95.
Separate large spindle for Monarch changer to play 45 RPM records automatically, $1.88.
S-78A, 11 tube Hallicrafters chassis only, Ship. wt. 22 lbs. Special sale price, $59.95.
S-78A chassis with 12" coaxial PM speaker, Ship. wt. 30 lbs. Both for only $69.95.

AIR KING FM-AM TUNER

SELF POWERED



Use with any Audio Amplifier

SALE PRICE **$24.99**

Air King factory built, 6 tubes self-powered FM-AM radio tuner. Receives broadcast 540 to 1620 kc and FM 88 to 108 mc. Use with any Hi-Fi audio amplifier or connect it to your TV set for FM-AM reception. Selector switch has 4 positions for TV-Phono-FM and AM. 3 other controls are volume-off-on, tone and tuning. With tubes: 12AT7, 2—6AU6, 6AL5, 6SQ7, and 5Y3 rectifier. Chassis size, 11½" x 7½" x 6¼" high. Illuminated slide rule dial 7½" x 2½", with escutcheon plate and knobs. Self-powered with its own power transformer. FM-AM tuner chassis No. 703 as used in Air King model 17K1C combination TV-Radio-Phono with power supply added. Note: A separate audio amplifier is required to operate a speaker. Stock No. AIR-K6, self-powered FM-AM tuner, complete. Ship. wt. 10 lbs. Sale price, $24.99.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

14 TUBE ESPEY HI-FI CUSTOM FM-AM CHASSIS

RESPONSE FROM 10-22,000 CPS—PUSH-PULL 6V6'S—TWIN TONE CONTROLS—WILLIAMSON TYPE CIRCUIT—INPUTS FOR V.R., CRYSTAL, TAPE, RADIO OR TV

SALE PRICE **$79.95** LESS SPEAKER

ESPEY MODEL HF-250C

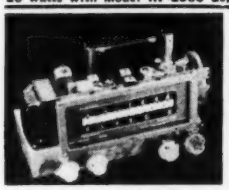
WITH MONARCH UA6U CHANGER $107.95

New 1956 model, 14 tube FM-AM chassis. A true Hi-Fidelity receiver built by a nationally famous maker of fine custom chassis. Espey Model HF-250C, 14 tube FM-AM chassis with push-pull 6V6, 10 watt audio. You could spend $200 to $250 for a separate tuner and amplifier and not have the quality of this receiver. Ultra-Linear output used in Williamson type circuit gives frequency response of 10 to 22,000 cps. Output taps of 4, 8 and 16 ohms. Separate RF stages for FM and AM assure high sensitivity. Temperature compensated FM front end for minimum drift. Separate bass and treble tone controls. Pre-amp for all types of magnetic cartridges. 2nd input for crystal phono, tape recorder or TV. 3 position equalizer for accurate reproduction of all records. Built-in antennas for both FM and AM. Response plus or minus 1 db from 10 to 22,000 cps. Harmonic distortion less than 1%. Sensitivity: FM, 8 mv for 30 db quieting; AM, 75 mv for 6 db signal to noise ratio. Off-on-volume and equalizer are combined on a concentric control. Has 2 AC outlets on rear of chassis. Beautiful edge lighted flywheel inertia slide rule dial. Size; 7¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable). Model HF-250C, Sale price, $79.95. With heavy duty Utah 15" coaxial PM speaker, both for only $99.95.

Buy either of these new Phillips "Norelco" speakers with your Espey chassis. Made by Phillips of Holland. Features Ticonal magnet, improved cone design, built-in mechanical cross-over and copper ring fitted into air gap keeps voice coil impedance independent of frequency.

Model 9760M, $54.95 list 12" Phillips speaker, response 30 to 20,000 cps, rated at 20 watts with Model HF-250C Espey chassis, both for only $99.95.

Model 9762M, $99.95 list 12" Phillips speaker, response 22 to 30,000 cps, rated at 20 watts with Model HF-250C Espey chassis, both for only $114.95.



HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER

BOTH FOR **$44.95**

9 TUBES-PLUS 2 RECTIFIERS

PHONO INPUT

10 W. AMP.

New Hi-Fi self-powered FM-AM tuner with 10 watt amplifier (push-pull 6V6's) on separate chassis. All you need is a record changer and speaker to have a complete home music system. 3 ft. cable connects tuner to amp. Tuner has input for crystal phono. (If changer with v.r. cartridge is purchased, we will include the necessary pre-amp, no charge.) Tuner has 6 tubes: 12AT7, 6BE6, 2-6AT6, 6AL5 and 6X4 rectifier. Amp has 2—6V6's, 6SN7 and rectifier. Full superhet circuit with AVC, 3 position tone control, 9" illuminated slide rule dial, escutcheon and knobs. Stick loop antenna for AM. Radio-FM-AM, phono selector switch, tone control, volume control on tuner. Response 50 to 17,500 cps. Receiver broadcast 540 to 1600 kc and FM 88 to 108 mc. Output matches any of the speakers shown above. No. FA9-2CR tuner and amplifier complete. Ship. wt. 22 lbs. Sale price, $44.95. CU-14V 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.

GOLDRING V. R. CARTRIDGE

WITH 2 SAPPHIRE STYLII $5.95
WITH 1 MIL DIAMOND, 3 MIL SAPH. $13.95

McGee offers the internationally famous Goldring variable reluctance phono cartridge, made in England and sold throughout the world to those who want the finest and most accurate music reproduction from 33⅓, 45 and 78 RPM high fidelity phono records. (Input gain and compensation similar to G.E. v.r. cartridge required.) Furnished as standard equipment with sapphire 1 and 3 mil styli. A regular $9.90 net item on sale at McGee for $5.95. For $13.95 with a diamond 1 mil stylus. These are the latest production, individually cartoned turnover cartridge with mounting bracket. Fits tone arms on most changers. Made for and bearing the famous Wilcox-Gay Recordio name. No. 546 Goldring V.R. (Wilcox-Gay) cartridge, Net $5.95. No. D546-DS, Goldring V.R. (Wilcox-Gay) cartridge with diamond 1 mil stylus, $13.95. 1 mil diamond stylus for Goldring V.R. cartridge, purchased separately, $9.95.

McGEE'S NEW PARTS CATALOG IS JUST OFF THE PRESS

1957 FREE CATALOG

order from this ad and one will be included with your order or mail us a postcard, we will mail you a copy

25 WATT, 6-110 VOLT AMPLIFIER ONLY... $69.95

COMPLETE 25 WATT, 6-110 VOLT P. A. SYSTEM

AMPLIFIER, MICROPHONE 2-TRUMPETS (AS ILLUSTRATED)

SALE PRICE **$149.95**

MG-625S, complete 25-watt, 6 volt DC and 110 volt AC sound system. Includes 2 model 848 Electro-Voice CDP coaxial horn projectors with drivers, a 25 watt push-pull 6L6, 6-110 volt amplifier, plus a $24.50 list Turner high impedance dynamic hand mike with off-on switch. McGee's special sale price, $149.95. Amplifier is not a kit, but our latest 1957 model, 25 watt 6-110 volt amplifier that operates equally well on a 6 volt storage battery or 110 volts AC. Amplifier features push-pull 6L6 output tubes, inputs for two high impedance mikes, 3 speed phono with crystal pickup built-in top. Phono top is packed separately for shipment. Only a few minutes required to plug-in phono and attach top cover to amplifier. Amplifier size, 13½"x10"x9½" high. Stock No. MG-625 amplifier only. A $100.00 net value. Sale price, $69.95. Complete 6-110 volt system as described above, Stock No. MG-625S complete with 2 Model 848 Electro-Voice speakers and Turner mike, Sale price, $149.95.

TIMEX MAGNETIC RECORDER

CRYSTAL PICKUP TO PLAY PHONO RECORDS, MICROPHONE AND 18 RECORDING BLANKS INCLUDED AT NO EXTRA CHARGE

SALE PRICE **$24.75**

MODEL 40 TIMEX

RECORDS AND PLAYS BACK PLAY 16⅔ AND 45 RPM RECORDS

A product of United States Time Corp. (Timex). A multiple purpose machine made to retail for $59.95. McGee bought a large quantity of these at a saving. Now you can save by buying this unit for only $24.75 complete with a pickup for playing 16⅔ and 45 RPM records, plus 18 additional recording blanks at no extra charge. Records and plays back at 16⅔ RPM on a wafer thin flexible disc. Up to 3½ minutes on each disc. Make recordings of your family—use for office dictation—dictate records that may be mailed without breaking. Don't overlook the possibilities of using this machine as a record player for 16⅔ RPM talking book records and regular 45 RPM records. Attractive brown plastic case, 9½"x11½"x4⅞". Turntable speeds of 16⅔ and 45 RPM. Response 100 to 4000 cps. Amplifier has neon level indicator, volume control and selector knob with playback, record and phono positions. Uses 12AX7, 50C5, 6C4 and 35W4 tubes. Built-in 4" speaker. Complete with Shure variable reluctance microphone, crystal pickup head for playing records and 18 recording blanks. Provides faithful reproduction at low volume of voice or music recorded through the microphone supplied or direct from your radio or TV. As simple to operate as a record player. Stock No. TIM-RIX recorder complete. Ship. wt. 13 lbs. Sale price, $24.75. Extra recording blanks, package of 6 for 99c.

FAMOUS STANDARD COIL CASCODE TUNERS

SALE PRICE **$12.95**

2 FOR $25.00

TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 1 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode model. Available with either 2⅞" or 4½" shaft length. A tremendous purchase makes our low $12.95 price possible. Specify shaft length desired. Stock No. TV-2000-3. Sale price $12.95 each, 2 for $25.00.

Matching knobs for Standard Coil tuners. Set No. SCK-2 for fine tuning and channel selector. Set VCK-2, matching volume and contrast knobs. Either set only 59c a pair.

STANDARD COIL PENTODE TUNERS $7.95

SC-948, Standard Coil, 21 mc Pentode tuner with 6BC5 or 6AG5 and 6J6 tubes. Popular 12 channel, 2 thru 13, used in millions of TV sets. Why spend time repairing an old tuner when it may be easier to just replace it. Shaft can be cut to desired length. Available with 2¾", 3", 4½" or 4½" shaft. Specify length of shaft. Sale price, $7.95 ea., 2 for $15.00. Matched knob set 59c extra.

TWO-TUBE SARKES-TARZIAN TV TUNER WITH TUBES

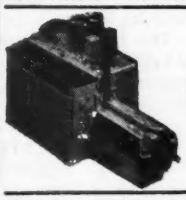
21MC OR 41MC $7.95

No. TT-3A, 2 tube Sarkes-Tarzian 12 channel TV tuner for 21mc. Used in CBS, Arvin, Crosley, etc. Ideal for general replacement. 3½" shaft. With tubes, $7.95 each, 2 for $15.00.

No. TT-2C, 2 tube Sarkes-Tarzian 41 mc Cascode tuner with tubes, 4½" shaft. Smallest cascode tuner made. Popular in many sets. $7.95 each, 2 for $15.00.

Either of the above tuners with 9" shaft, $1.00 extra.

Type 3, 3 tube 21 mc Sarkes Tarzian tuner with tubes. Rotary switch type complete with 6C4, 6BH6 and 6AG5 tubes. Regular cost is several times our new low price of only $4.95. Wired, ready to hook-up to video and sound I.F. strip. Use with either separate sound or inter-carrier. Built-in fine tuning. 2⅞" shaft. Net, $4.95.

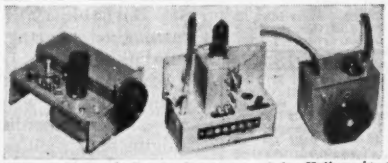


RCA KRK-12 TV TUNER Brand New—with Tubes

SALE PRICE **$6.95**

2 for $13.00

RCA Model KRK-12, UHF-VHF TV tuner with tubes: 2—6BQ7A, 6AF4 and 6S4. A complete tuner with all 12 VHF strips, but with blank strips in the UHF positions. This tuner fits many RCA sets using 40 megacycle I.F's. 270382 also KCS-66, etc. Original tuner list was about $50.00. We offer them new at about the value of the tubes. Ship. wt. 10 lbs. McGee's sale price, $6.95 each, 2 for $13.00.



UHF CONVERTER TUNERS $2.95 3 FOR $7.50

Take your choice of any of these three UHF converter-tuners at $2.95 each, 3 for $7.50. (1) Mallory inducto-tuner with 6AF4 and 1N72 diode. This is a complete UHF osc-tuner similar to the one used by Mallory in a converter and by many set manufacturers in their UHF TV sets. (2) CBS-Columbia single channel UHF converter intended for use in UH11 and UH12 CBS TV sets. Complete with 6AF4 tube. (3) Small compact UHF converter tuning assembly with 6AF4 tube and diode. Many applications for this in UHF. Your choice of any of these for only $2.95 each, or 3 assorted for $7.50.

MINIATURE BROADCASTING STATION FOR MICROPHONE AND PHONO WITH CRYSTAL MICROPHONE

SALE PRICE $9.95

Sensational new model MCL-E3 miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like a radio station. Has input jacks for crystal mike or record player. Complete with 12K8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete with crystal hand mike and instructions. Ship. wt. 4 lbs. Net price $9.95.

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PRICES F.O.B. KANSAS CITY. SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

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RADIO & ELECTRONICS TRAINING AT HOME

BUILD 16 RADIO CIRCUITS AT HOME

Progressive Radio "Edu-Kit" only **$19.95**

A PRACTICAL HOME RADIO COURSE

Now Includes
SOLDERING IRON, TESTER, HIGH FIDELITY, SIGNAL TRACER, CODE OSCILLATOR, PRINTED CIRCUITRY

FREE TOOLS

- No Knowledge of Radio Necessary
- No Additional Parts or Tools Needed
- Excellent Background for TV
- Unconditional Money-Back Guarantee

FREE Hi-Fi, Radio & TV Servicing Manuals on Request. (See Coupon Below).

WHAT THE "EDU-KIT" OFFERS YOU

The 1957 "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. You will learn radio theory, construction and servicing. You will learn how to build radios, using regular schematics; how to solder and wire in a professional manner; how to service and trouble-shoot radios. You will learn how to work with punched metal chassis as well as the new Printed Circuit chassis. You will learn the principles of RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for TV. In brief, you will receive a basic education in Electronics and Radio, worth many times the small price you pay, only $19.95 complete.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." You begin by building a simple radio. Gradually, in a progressive manner, and at your own rate, you construct more advanced multi-tube radio circuits, learn more advanced theory and techniques, and do work like a professional radio technician.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. The "Edu-Kit" is used by young and old, schools and clubs, by Armed Forces Personnel and Veterans Administration for training and rehabilitation. The "Edu-Kit" is used in 79 countries throughout the world.

Designed for universal use, the "Edu-Kit" operates on any voltage from 105 to 125 volts, AC and DC. For use in countries employing higher line voltages, a 210-250 Volt AC/DC model is available.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, etc. In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered, dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code instructions and the Progressive Code Oscillator. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide, FCC Amateur License Training Book, and a Quiz Book.

All parts, components, etc. of the "Edu-Kit" are 100% unconditionally guaranteed, brand new, carefully selected, tested and matched. Everything is yours to keep. The complete price of this practical home Radio and Electronics course is only $19.95.

TROUBLE-SHOOTING LESSONS

You will learn to trouble-shoot and service radios, using the professional Signal Tracer, the unique Signal Injector, and the dynamic Radio and Electronics Tester. Our Consultation Service will help you with any technical problems.

J. Stasaitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a course, but I found your ad and sent for your kit."

FREE EXTRAS

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☐ "Edu-Kit" Postpaid. Enclose full payment of $19.95.
☐ "Edu-Kit" C.O.D. I will pay $19.95 plus postage.
☐ Send me FREE additional information describing "Edu-Kit." Include FREE valuable Hi-Fi, Radio & TV Servicing Manuals. No obligation.

(Outside U.S.A.—No C.O.D.'s. "Edu-Kit" for 105-125 V. AC/DC $20.95; 210-250 V. AC/DC $23.45.)

Name .....

Address .....

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PROGRESSIVE "EDU-KITS" INC.
497 Union Ave., Room 60-E, Brooklyn 11, N. Y.

IRC DATA SHEETS

International Resistance Company, 401 N. Broad St., Philadelphia 3, Pa., has issued three new carbon resistor bulletins of interest to the industry.

Bulletin B-9 provides comprehensive data on construction, application, types, tolerance, resistance element, terminals, etc., for the company's line of molded deposited carbon units. Bulletin B-4 provides the same information on the deposited carbon units while details on the firm's molded boron carbon resistors are contained in Bulletin B-8.

Copies of any or all of these data sheets are available without charge upon written request to the manufacturer.

MAGNETRON BOOKLET

The Tube Division of *Radio Corporation of America,* Harrison, N. J., has published a 40-page booklet entitled *"RCA* Magnetrons and Traveling-Wave Tubes."

The booklet describes the theory and operation of magnetrons and traveling-wave tubes, their operating considerations and applications, and techniques for measurement of important electrical parameters.

Illustrations show the structural parts of both tube types, typical performance characteristics, test methods, and representative circuit applications. Data is given on four magnetrons and one traveling-wave tube.

The booklet, publication MT-301, is available from the Commercial Engineering Dept. of the Tube Division for 50 cents a copy.

ENCAPSULATED RESISTORS

Cinema Engineering Division of *Aerovox Corporation,* 1100 Chestnut St., Burbank, Calif., has issued a new catalogue covering its line of encapsulated resistors.

The 20-page booklet covers the firm's entire line of wirewound, fixed, and accurate encapsulated units. The catalogue also includes a military specification table.

The information provided includes line drawings of the units as well as descriptive tabulations.

MERIT "REPL" GUIDE

Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill., has announced publication of its 1957 "Repl" guide.

This is the 9th consecutive all-industry replacement guide issued by this manufacturer. Designated as the #409, the guide contains 128 pages of complete coil and transformer replacement information on approximately 20,000 TV models and chassis. There are 155 brand names represented in the listing.

Copies of the guide are available from electronic parts distributors throughout the U. S.

ALDEN SUPPLEMENT

Alden Products Company, 117 N. Main St., Brockton 64, Mass., has released a 4-page handbook supplement which describes a new series of "IMI" connectors.

These integral molded insulation type units are described in some detail in the data sheet along with application information and photographs of the various connectors.

Copies of this new publication will be supplied without charge upon request to the company.

FUSE RESISTOR DATA

International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pa., is now offering a catalogue data bulletin which carries comprehensive information on the applications, advantages, design, construction, ranges, tolerance, stamping, derating, etc., of its Type FR fuse resistor.

Detailed charts and graphs have also been included. Specify Bulletin P-3 when writing for a free copy.

POWER SUPPLY DATA

Kepco Laboratories, 131-38 Sanford Avenue, Flushing 55, N. Y., has issued a four-page data sheet covering its line of voltage-regulated power supplies.

Bulletin B-356 pictures and describes a series of these units, along with pertinent data and electrical specifications.

The data sheet will be supplied without charge upon written request.

FREE REFERENCE CHART

United Catalog Publishers, Inc., has compiled a special industry-wide chart covering panel and flashlight lamps as a service to dealers, distributors, technicians, and others in the field.

The chart is a composite listing, arranged numerically, of all panel and flashlight lamps manufactured by *General Electric, Eveready, RCA, Raytheon, Tung-Sol,* and *Westinghouse.* Simply by checking the lamp number, the user can determine at a glance the respective manufacturer, bulb type, base, voltage, amperage, and bead color. All bulb types are illustrated and physical dimensions are provided.

The chart will be supplied free upon request to *"The Radio-Electronic Master,"* 106 Lafayette St., New York 13, N. Y.

ALNICO MAGNETS

Park Magnet Company, 1557 Green Bay Road, Highland Park, Ill., is offering a single-page data sheet which describes and illustrates a variety of Alnico magnets stocked by the firm.

Horseshoe, rod, bar, disc, and channel types are shown, together with dimensions and rated pulling power. Also

LIFETIME GUARANTEED TUBES

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PICTURE TUBES

- RCA Licensed
- One Year Unconditional Guarantee

Type	Price	Type	Price
10BP4	$11.90	17BP4	$20.63
12LP4	$14.38	19AP4	$24.81
14BP4	$16.86	21AP4	$28.79
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16LP4	$19.38	24AP4	$42.50

Picture Tubes shipped F.O.B. Harrison, N. J. Above types are most popular. However, you may order any equivalent size at the same price.

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TV SETS

Picture Tube Guaranteed To Work!

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- RCA
- Philco
- GE
- Motorola
- Zenith
- Capehart
- Others

10" SET Table Model ... $16.95 Console ... $19.95
12" SET Table Model ... $22.95 Console ... $24.95
14" SET Table Model ... $27.95 Console ... $31.00
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All prices F.O.B. Harrison, N. J. Prices on request for 19", 20", 21" and 24" sets.

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NEW INDOOR

ANTENNA

Both UHF and VHF. Brings better reception than most outdoor antennas. Use on top of TV.

List Price $9.95

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Lots of 3 **3.29**

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LOOK WHAT YOU GET FREE!

FREE BONUS BOX
- 1 RCA Cheater Cord
- 10 Assorted resistors
- 10 Assorted 2 color "blank" tube cartons

With Every $25 Order
- 1 6BQ6GT tube
- 1 6AV6 tube
- 1 6CB6 tube

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With Every $125 Purchase Within 30 Days

Wakemaster clock radio with famous Sessions clock movement wakes you to music or alarm. May be purchased outright for $17.95. BRAND for $17.95. In ivory or rust.

HERE'S HOW LIFETIME GUARANTEED TUBES SAVE YOU MONEY!

- We Guarantee to Replace ALL TUBES Purchased From Our Firm Forever
- Each Tube Individually Boxed and Guaranteed
- Over A Half Million Tubes Always in Stock
- Immediate Shipment
- Free Postage On All Orders With Full Remittance
- There are fewer "call backs"
- There are no "out of date" tubes
- "Peak Performance" testing in our fully equipped Testing Department before shipment guarantees quality

0Z4	.43	3BN6	.70	6AV6	.39	6K8	.65	7C6	.43	14B6	.38
1A7GT	.43	3CB6	.52	6AX4GT	.60	6L6	.68	7C7	.45	14Q7	.50
1A7G7	.43	3Q4	.46	6AX5GT	.57	6L7	.42	7E5	.45	19BG6G	1.15
1B3GT	.65	3Q5GT	.57	6B4G	.52	6N7	.60	7E6	.55	19T8	.65
1C5GT	.41	3S4	.47	6B8	.69	6Q7	.40	7E7	.70	24A	.39
1D5GP	.43	3V4	.47	6BA6	.47	6S4	.40	7F7	.59	25AV5GT	.78
1E7GT	.41	4BQ7	.89	6BA7	.58	6SA7	.45	7F8	.70	25BQ6GT	.78
1G6GT	.41	4BZ7	.95	6BC5	.47	6SC7	.48	7G7	.75	25L6GT	.47
1H4G	.43	5AW4	.75	6BC7	.80	6SG7	.41	7H7	.50	25W4GT	.43
1N5GT	.47	5BG6G	1.15	6BE6	.45	6SH7	.43	7J7	.75	25Z5	.37
1J6GT	.47	5J6	.63	6BF5	.40	6SJ7	.43	7K7	.75	25Z6	.37
1L4	.45	5T4	.69	6BF6	.50	6SK7	.45	7L7	.75	27	.25
1L6	.55	5U4G	.43	6BH6	.50	6SL7GT	.55	7N7	.50	35A5	.46
1LA4	.57	5U8	.74	6BJ6	.47	6SN7GT	.55	12AT6	.37	35B5	.50
1LA6	.47	5V4G	.59	6BK5	.68	6SQ7	.39	12AT7	.66	35C5	.50
1LB4	.57	5Y3	.31	6BK7	.76	6SR7	.42	12AU6	.41	35L6GT	.47
1LC5	.49	5Y4G	.36	6BL7GT	.75	6SS7	.41	12AU7	.53	35W4	.34
1LC6	.47	5Z3	.41	6BN6	.58	6T4	.95	12AV6	.35	35Y4	.34
1LD5	.57	6A7	.57	6BQ6GT	.78	6T8	.68	12AV7	.67	35Z3	.39
1LE3	.57	6A8	.45	6BQ7	.78	6U8	.75	12AX4GT	.65	35Z5GT	.34
1LG5	.57	6AB4	.43	6BY5G	.58	6V3	.80	12AX7	.58	37	.29
1LH4	.84	6AC7	.67	6BZ7	.88	6V6GT	.46	12AZ7	.63	50A5	.46
1LN5	.47	6AF4	.79	6C4	.37	6W4GT	.39	12B4	.68	50B5	.50
1N5GT	.50	6AG5	.50	6C5	.35	6W6GT	.53	12BA6	.46	50C5	.50
1R5	.50	6AG7	.69	6CB6	.49	6X4	.34	12BD6	.48	50L6GT	.43
1S5	.42	6AH6	.89	6CD6G	1.15	6X5	.34	12BE6	.48	75	.42
1T4	.50	6AJ5	.70	6D6	.48	6X8	.73	12BH7	.60	76	.42
1U4	.47	6AK5	.54	6E5	.44	6Y6G	.55	12BY7	.65	77	.38
1U5	.42	6AL5	.39	6F5	.37	7A4	.45	12BZ7	.61	78	.38
1V2	.65	6AQ5	.46	6F6	.38	7A5	.53	12CU6	.95	80	.34
1X2	.81	6AR5	.46	6G6	.40	7A6	.45	12SA7	.45	84/6Z4	.44
2A3	.88	6AS5	.48	6H6	.38	7A7	.43	12SJ7	.45	117L7GT	1.09
2A5	.57	6AS6	1.70	6J4	1.79	7A8	.45	12SK7	.45	117N7GT	1.09
2A7	.55	6AS7G	2.19	6J5	.39	7B5	.39	12SN7GT	.56	117P7GT	1.09
3A4	.51	6AT6	.39	6J6	.47	7B6	.42	12SQ7	.37	117Z3	.35
3A5	.50	6AU4GT	.65	6J7	.43	7B7	.41	12SR7	.45	117Z6GT	.63
3AL5	.45	6AU5GT	.59	6J8G	.85	7B8	.45	12V6GT	.45		
3AU6	.46	6AU6	.42	6K6GT	.37	7C4	.39	12X4	.37		
3BC5	.54	6AV5GT	.65	6K7	.39	7C5	.42	14A7	.42		

WE PAY ALL POSTAGE on receiving tubes orders shipped in USA, Territories and APO's. Send only purchase price of merchandise. Please include approximate postage on foreign shipments. All orders subject to prior sale. Add 25c handling on orders under $5.00. Quantity users write for special discount.

Write for FREE Tube List—Order Blank—and FREE Sample Tube Carton. We want Y-O-U on Our Mailing List!

SPECIAL SURPRISE

Mention where you saw our ad and we will send you FREE three 6SNGT's with any order of $10 or more.

FREE GIFT CERTIFICATE*

worth $5 toward the purchase of any of our merchandise on future orders will be sent with any order of $50 or more.

* Free Gift Certificate cannot be used to obtain another certificate unless order is $55 or more.

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Romano Bldg. Harrison, N. J.

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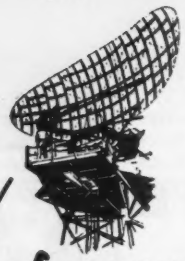

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Industry needs Electronic Trained Men Now! Qualify for BIG PAY JOB, 9 short months. No other type of training can compare with actual shop practice you get at Healds under expert instructors.

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San Francisco, Calif.

included are representative costs of cut-to-size segments and details on the firm's line of heavy-duty, high-powered retrieving magnets.

Write the company direct for a copy of Catalogue Sheet #200.

CONELRAD INSTRUCTIONS

As a public service *Kaar Conalert*, P. O. Box 1320, Palo Alto, Calif., is offering a wall card imprinted with instructions on what to do in case of a Conelrad alert.

Available without charge, the card is designed to be hung on the wall in front of the operator of a base radio station. It outlines the procedures which must be followed to comply with FCC rules regarding such alerts.

Copies may also be obtained from representatives and authorized outlets handling the products of *Kaar Engineering Corp.*

THRESHOLD INDICATOR

Literature describing its new threshold indicator, Model 91296-1, is now available from *Stoddart Aircraft Radio Co., Inc.*, 6644 Santa Monica Blvd., Hollywood 38, Calif.

The single-page data sheet describes the unit as a signal actuated "go-no-go" accessory which may be used with the company's radio-interference meters to operate a bell, lamp, or other alarm system when radio interference exceeds the limits of military specifications.

The device may be used in any system to indicate when a predetermined audio signal level is exceeded. Monitoring may be performed and the equipment operated by non-technical personnel. All information regarding the indicator and the measuring units with which it may be used is included in the brochure.

SERIES-STRING TUBES

General Electric Company's Tube Sales Department, 1 River Road, Schenectady, N. Y., has issued a revised "Quick Selection Chart" covering its line of series-string receiving tubes.

The chart, publication ETD-1163-C, includes both 600 and 450 ma. controlled-heater warm-up tubes. It classifies 52 tube types in the 600 ma. series and 24 types in the 450 ma. series according to elements, typical service, heater voltages, maximum ratings, and gives average characteristics.

The chart is available upon request to the company.

TRADE ASSOCIATION LISTING

The Trade Association Division of the Office of Technical Services, U. S. Department of Commerce, has released a new directory listing over 2000 national trade associations and related organizations of businessmen.

The directory gives the mailing address and the name and title of the key executive in each organization. An index facilitates the location of associations in particular product or service fields.

The "Directory of National Trade Associations" is available from the Su-

Ham Special! Famous BC-645 XMITTER-RECEIVER

With DIAGRAM for Easy Conversion to CITIZENS' BAND!

Makes wonderful mobile rig for 420-500 Mc. Easy to convert for phone or CW 2-way communication. CONVERSION DIAGRAM INCLUDED. This swell rig originally cost over $1000—yours for practically a song! You get it all, in original factory carton, BRAND NEW, complete with 17 tubes, less power supply. **Conversion Instructions Included.** Shpg. wt. 25 lbs. **$29.50**

PE-101C DYNAMOTOR for BC-645, has 12-24V input (easy to convert for 6V Battery operation) ..... only **$7.95**
UHF ANTENNA ASSEMBLY, for BC-645 ..... **$2.45**
Complete set of 10 Plugs for BC-645 ..... **$5.50**
CONTROL BOX for above **$2.25**
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TS-100/AP OSCILLOSCOPE

Can be used with linear sweep or general purpose test scope. Cables included. Self-contained in metal case 8x12½x16" deep. For 110 V. 50 to 1200 cycles AC. Demilitarized, new, with all tubes incl. crystals and C.R. Tube. Worth $750! BRAND NEW, Our Low Price **$34.50**

TS-16/APN TEST SET, BRAND NEW, complete with all cables **$12.95**

BENDIX DIRECTION FINDER

MN-26-C. 12-tube remote control Navigation Direction Finder and communications receiver. 150 to 1500 Kc in 3 bands. 28 V. DC input. Ideal for commercial navigation on boats and planes. Complete installation comprises:
MN-26-C Receiver, used, with 12 tubes **$16.50**
MN-26-C With 12 Tubes, BRAND NEW **$22.50**
MN-20-E Rotatable Loop 4.25
MN-52 Azimuth Control Box 2.95

MN26Y BENDIX DIRECTION FINDER

150 Kc. to 7 Mc. Complete with tubes, motor. BRAND NEW **$26.95**
Used, like new, incl. tubes and dynamotor **$18.95**

NEW! Cathode Ray Tubes NEW!

3CP1	$ .88	5BP4	$2.22
3FP7	.88	5CP1	2.45
5BP1	2.22	9LP7	1.85

RCA 826 TRANSMITTING TUBES, NEW ..... Each 44¢

Loran APN/4 Oscilloscope

Easily converted for use on radio-TV Service Bench!

BRAND NEW
Completely Assembled

Supplied with 5" Scope type 5CP1 and RCA 100 Kc. Crystal Unit **$14.95**

BC-605 INTERPHONE AMPLIFIER. Easily converted to intercom set—ideal for office, home or factory! BRAND NEW, with original schematic **$4.44**

DYNAMOTOR VALUES!

Type	Input	Output	Excellent Used	BRAND NEW
DA-19-A	28V 11A	400V .400A	$4.99	$6.95
DM-28	28V	224V .07A	1.95	4.95
DM-32A	28V 1.1A	250V .05A	2.95	5.95
DM-33A	28V 5A	575V .16A		
	28V 7A	540V .25A	1.95	3.95
DM-34D	12V 2A	220V .080A	4.25	5.50
DM-37	25.5V 9.2A	625V .225A	5.95	8.95
DM-40	14V 3.4A	172V .138A	1.75	3.45
DM-53A	28V 1.4A	220V .080A	3.95	5.95
DM-64A	12V 5.1A	275V .150A	....	7.95
PE-73C	28V 20A	1000V .350A	8.50	11.50
PE-86	28V 1.25A	250V .050A	2.95	5.24
PE-103	6V	500V .160A		
	12V	500V .160A	19.50	34.50
PE-186	28V 11A	400V .400A		6.95

SPECIAL G.E. DYNAMOTOR

INPUT: 28 V. D.C. @ 19 A.
OUTPUT: 1000 V. D.C. @ .350 A.
Model 5D48B9A. **BRAND NEW** **$4.95**

2 VOLT BATTERY "PACKAGE"

1—2V. 20 Amp. Hr. Willard Storage Battery. **$2.45**
1—2V. 7 prong Synchronous Plug-in Vibrator **1.49**
1—Quart Bottle Electrolyte (for 2 cells) ... **1.45**
ALL BRAND NEW!
Combination Price ... $4.99

Willard 6-Volt Midget Storage Battery
3 Amp. Hour. **BRAND NEW.** 3⅝" x 1-13/16" x 2⅝". Uses Standard Electrolyte ..... Only **$2.22**

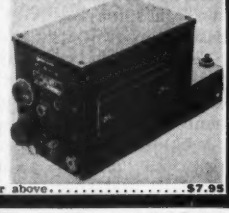
ASB-5 RECEIVER FOR 420 Mc BAND!

As featured in "CQ" for October 1956. Easily converted, makes a marvelous receiver for 420 Mc band, with RF amplifier! Supplied complete with all tubes.
OUR LOW PRICE **$14.95**
ASB-5 INDICATOR **$16.95**

I-95-M FIELD STRENGTH METER

Tunes 100 to 155 Mc. Made for Signal Corps. Like New **$34.50**

AN/ARR-2 RECEIVER



BRAND NEW — A Terrific Value! Tuning Range 234 to 258 Mc. Tubes: 7-6001, 3-6AK5, 1-12A6. Only a few at this low price! Complete **$8.88**
With 28 V 1.6A Dynamotor, complete **$12.95**
110 VOLT AC POWER SUPPLY KIT for above **$7.95**

DYNAMIC HANDMIKE, with "Press-to-talk" Switch, cord and plug—BRAND NEW, only **$2.95**
DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special **$2.95**
SOUND POWER Headphone with Dynamic Mike, BRAND NEW **$3.95**

HI-FI DYNAMIC HEADSET with Cushions
Freq. Range: 40-14000 CPS. No Distortion. BRAND NEW **$5.95**

MICROPHONES

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike	$5.45	$7.95
T-30	Carbon Throat Mike ...	.33	.69
T-45	Navy Lip Mike	....	.99
RS-38	Navy Type	2.45	4.95
T-24	Carbon Mike	....	3.95
TS-9	Handset	....	4.95

HEADPHONES

Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	$2.25	$4.35
HS-33	Low Impedance	1.99	4.65
HS-30	Low Imp. (featherwt.) .	1.49	2.25
H-16/U	High Imp. (2 units) ...	2.75	7.95
CD-307A	Cords, with PL55 plug and JK26 Jack		.99

BC-906 FREQ. METER—SPECIAL!

Cavity type, 144 to 235 Mc. BRAND NEW in original factory packing, complete with antenna & operating manual.
OUR LOW PRICE **$8.88**

BC-221 FREQ. METER **$129.50**

BC-221 FREQ. METER CASE

Aluminum case for BC-221 or TS-164 Freq. Meters. With volt. reg. supply using VR105. 2 ballast tubes, relay, cable, etc. Inside front: 9¾ x 7½ x 7⅞". Inside rear: 2" deep. Shock-mounted. **BRAND NEW,** (Add 50c for packing) **$3.99**

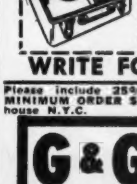
Original Crystal for BC-221 1000 Kc BRAND NEW **$8.45**

TG-34A CODE KEYER

Self-contained automatic unit, reproduces code practice signals recorded on paper tape. By use of built-in speaker, provides code-practice signals to one or more persons at speeds from 5 to 25 WPM.
BRAND NEW. In original carton.
TAPES FOR ABOVE AVAILABLE **$19.95**

TG-5-B TELEGRAPH SET

Made for USA Army Signal Corps. A dandy little field set for 2-way communication. Sturdy metal container, 6¾"x 4¾"x4", with hinged covers, complete with telegraph key and headset. BRAND NEW, in carrying case with shoulder strap **$9.95**
Used, exc. Cond. **$7.95**



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BC1206-C BEACON RECEIVER

195 to 420 Kc. made by Setchel-Carlson. Works on 24-28 volts DC. 135 Kc. IF. Complete with 8 tubes. Size 4" x 4" x 6". Wt. 4 lbs. **BRAND NEW** .. **$8.88**
Brand New, less tubes .. $5.95
USED, with tubes $5.95
USED, less tubes 2.95

SCR-522 2-METER RIG!

Terrific buy! VHF Transmitter-receiver, complete with all components. 100-156 Mc. 4 channels. Xtal-controlled, Amplitude modulated voice. They're going fast! Excellent condition.
SCR-522 Transmitter-Receiver, complete with all 18 tubes.
COMBINATION ..... Special $33.33
Receiver Only, with all tubes ... $19.50
Transmitter Only, with all tubes . $22.25

ARC-5/T-23 TRANSMITTER

Includes 2-832A, 2-1625 Tubes.
Excel. Used **$14.95**
BRAND NEW **$21.50**

ARC-5 MARINE RECEIVER-TRANSMITTER

Navy Type Comm. Receiver 1.5 to 3 Mc BRAND NEW with 6 tubes **$16.95**
Navy Type Comm. Transmitter 2.1-3 Mc BRAND NEW with 4 tubes and Xtal **$12.45**

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Four Band. 105 to 9050 kc. Low Freq., Ship, Broadcast—40 to 80 meters. Includes tubes and dynamotor, for 24 volt operation. Easily converted for 110 V., 12 V, or 6 V. Schematic Included. Excellent Condition. Overall: 8¼" x 7¼" x 15¼". Wt. 30 lbs.
COMPLETE WITH ALL TUBES, Special **$21.50**

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FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or plane! Complete, BRAND NEW installation consists of: ID-6B/APN-4 Indicator; R-9B/APN-4 Receiver; PE-206 Inverter; Set of Plugs; Visor for Indicator; Operation manual; Brand New, Export packed. **COMPLETE** **$129.50**

SPECIAL APN-9A LORAN Receiver Indicator, less tubes, NEW (demilitarized) **$29.50**

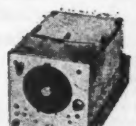
BRAND NEW SELSYNS

Operates from 57½ volts, 400 cycles. New tested. Conversion diagram for 110 volts AC included.

		Any Type
BRAND NEW.		
2J1F1	Selsyn Generator.	$2.95 Each
2J1G1	Selsyn Control Transformer.	
2J1H1	Selsyn Differential Generator.	

CAPS FOR ABOVE 50c

R24-ARC/5 NAVY TYPE (Similar to BC-946) BROADCAST RECEIVER



520 to 1500 Kc. 6 tubes: 3—12SK7, 12SR7, 12A6, 12K8. For dynamotor operation. Easily converted to 110 or 32 Volt. 2—IF stages, 3-gang tuning cond. Complete with all tubes, in original sealed carton. BRAND NEW .. **$19.95**

BC-457 TRANSMITTER—4-5.3 Mc. complete with all tubes and crystal. BRAND NEW .. **$7.88**
BC-458 TRANSMITTER—5.3 to 7 Mc. Complete with all tubes and crystal. BRAND NEW **$7.88**
BC-459 TRANSMITTER—7-9.1 Mc. complete with all tubes and crystal. BRAND NEW **$11.95**
BC-696 TRANSMITTER—3 to 4 Mc. BRAND NEW complete with all tubes & crystal .. **$8.88**

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES Type	Description	Excellent Used	Brand New	NEW
BC-453	Receiver 190-550 KC ...	$9.95	$11.95	$14.95
BC-454	Receiver 3-6 Mc.	7.19	8.29	11.95
BC-455	Receiver 6-9 Mc.	5.25	7.95	9.95
BC-456	Modulator	2.24	2.75	4.24
BC-450	3-Receiver Control Box	...	1.49	1.95
BC-451	Transmitter Control Box	...	1.25	1.49
BC-696	Xmtr 3-4-Mc (like new)	...	6.95	8.88

110 VOLT AC POWER SUPPLY KIT

For All 274-N and ARC-5 Receivers

Can be assembled quickly and easily, on pre-drilled chassis. Plugs into the rear of any model 274-N receiver and delivers 24 volts as well as "B" voltage. Complete kit of parts with metal case, instructions. **SPLINED TUNING KNOB** for 274-N RECEIVERS. Fits BC-453, BC-454 and others. **$7.95**
Only **49c**

BC-442 ANTENNA RELAY

Wonderful Value! Consists of ¾ amp 2" RF Ammeter (antenna current indicator, 0-10 scale, Transmitter-Receiver Switching relay, in aluminum case with associated components. BRAND NEW **$2.24**

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NEW LAFAYETTE CATALOGUE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., has just released copies of its Catalogue No. 300, a 164-page listing of hundreds of items of interest to the electronic industry, hobbyists, radio amateurs, and experimenters.

Included are photographs and descriptions on an extensive line of standard and special parts, kits of all types, assembled equipment, audio gear, test instruments, books, Geiger counters, etc.

Copies of this comprehensive catalogue will be supplied on request.

PICTURE TUBE REPLACEMENTS

A wall chart to aid service dealers in selecting picture tube replacements is being offered by *General Electric Company* through its authorized tube distributors.

The chart, entitled "Television Picture Tube Replacement Chart," lists all of the types available on the market at this time. A feature of the chart is listing of both aluminized and non-aluminized tube replacements, where available, for each of the 223 tubes.

Tubes are classified by size, base, bulb structure, external coating, anode contact, focus method, deflection angle, over-all length, bulb diameter, neck length, anode kv., and type of ion-trap magnet. Characteristics of color picture tubes are also listed.

TRANSISTOR TRANSFORMERS

Argonne Electronics Mfg. Corp., 27 Thompson St., New York 13, N. Y., has issued a four-page data sheet covering its line of transformers designed especially for transistor circuitry.

In addition to supplying complete specifications on the transformer line, the brochure includes details on a midget variable capacitor, transistor oscillator coils, transistor loop antennas, and miniature dials.

INSTRUMENT CATALOGUE

Electro-Measurements, Inc., 7524 S.W. Macadam, Portland 1, Ore., has just released a short-form catalogue covering its line of precision test instruments.

Prices and brief specifications are listed. Included are precision impedance and comparison bridges, decade resistance and capacitance standards, and high linearity decade voltage dividers.

KAY INSTRUMENT CATALOGUE

Kay Electric Company, 14 Maple Ave., Pine Brook, N. J., has issued a 48-page catalogue covering its line of electronic instruments.

Some 66 laboratory and production line instruments are described in detail along with a photograph of each unit, complete electrical and physical specifications. —30—

The new IBM electric typewriter with electronic tabulation is designed to speed the preparation of business forms containing blank fill-in areas. The electronic "reading" feature of the new typewriter eliminates time-consuming tabulating adjustments when using a variety of forms. Vertical lines printed on the form with electrically conductive ink make the form sensitive to electrical impulses. These conductive lines, in effect, program the typewriter. When the tab key on the keyboard is depressed, a tiny sensing unit close to the paper "reads" the form and automatically positions the typewriter carriage at the correct typing point. The electronic unit required for this operation (see inset) is mounted beneath the keyboard and is confined to a small metal container within the case, about 3 x 6 inches in size.

Improving Your Tube Tester

By **ELLIOT A. McCREADY**

Modification of shorts test provides more exact meter reading in place of an arbitrary neon bulb indication.

AS A SHORTS indicator, most tube checkers use a neon bulb with a sensitivity of about 300,000 to 500,000 ohms. A simple and inexpensive modification of this circuit to permit actual measurement of leakage in ohms expands the checker's usefulness considerably.

The modification described here was added to the *Heathkit* Model TC-1, a conventional checker. Inter-element resistance up to 10 megohms can now be measured with ease and unbalance between the sections of a dual tube can be spotted instantly.

The circuit consists of an ordinary ohmmeter with a center scale reading of about 250,000 ohms. Power for the meter is obtained from the 100-volt winding of the power transformer, which was formerly part of the original shorts-indicating circuit of Fig. 1. This 100 volts a.c. is rectified, filtered, and applied through a limiting resistor to the tube checker meter (Fig. 2) and thence to the elements of the tube under test. Rectifier output must be negative, with meter connections made accordingly, otherwise emission of the tube being checked would make a resistance check impossible.

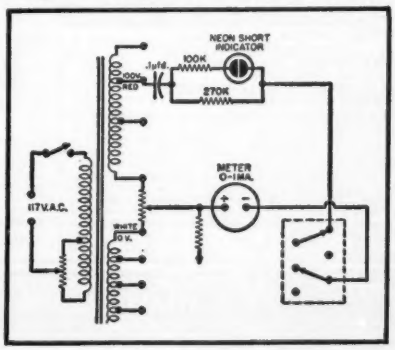
Components originally used for the shorts test—the 0.1 μfd. capacitor, the 100,000 and 270,000 ohm resistors, the neon bulb, and associated hardware and wiring—are disconnected. S_1, a d.p.d.t. toggle switch, is added to switch the checker meter from the line-adjust test circuit to the short-indicator test circuit. The zero-adjust control R_1 should rarely need adjusting once set. R_2 and R_3 should total about 130,000 ohms. (With none of the values in this circuit being critical, components were selected from the junk box.) Rectifier output is approximately 150 volts d.c., so the total limiting resistance (R_1, R_2, and R_3) is adjustable from about 130,000 to 160,000 ohms (for a 1-ma. meter).

S_1 is wired into the circuit so that it puts the meter into the short-indicating circuit when the tester's switch is thrown into the short-test position. After wiring has been completed and checked, the meter face can be marked with some resistance values. Only a few values are necessary: .05, .1, .25, .5, 1, 2, and 3 megohms should suffice. Calibration may be accomplished by connecting a variable resistor to any socket pins on the tester and noting the meter readings as the resistor is varied.

Operation

With a tube inserted in the checker, S_1 is thrown to the "up" position to permit adjustment of line voltage. This switch is then returned to its "short" position, as shown in Fig. 2, and a complete shorts test is made in the manner prescribed for the particular checker. Critical reject values for various types of tubes in various circuits may be determined. Most good tubes will indicate from about 10 megohms to infinity. —30—

Fig. 1. Original shorts test circuit.



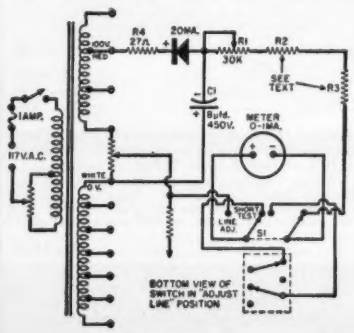
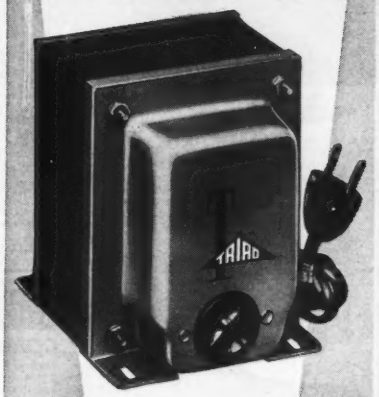


Fig. 2. The revised circuit uses a d.c. voltage and a meter to measure leakage.

R_1—30,000 ohm pot
R_2—100,000 ohm, ½ w. res. (see text)
R_3—33,000 ohm, ½ w. res. (see text)
R_4—27 ohm, ½ w. res.
C_1—8 μfd., 450 v. elec. capacitor
S_1—D.p.d.t. toggle switch
1—20 ma. selenium rectifier

TRIAD ISOLATION TRANSFORMERS



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Triad Isolation Transformers are especially designed for isolation of laboratory test equipment . . . reduction of line disturbances . . . elimination of undesired grounds.

They are ideal for use in screen rooms. Such construction features as "Climatite" treatment, liberal use of high quality materials and static shielding insure optimum performance and long life.

Type No.	List Price	V. A. Output	Input Volts	Output Volts
N-51X	$ 7.10	35	115	115
N-68X	8.95	40	230/115	115
N-53M	14.00	85	115	115
N-54M	17.10	150	115	115
N-67A	16.30	150	230/115	115
N-55M	30.20	250	115	115
N-66A	25.40	250	230/115	115
N-57M	50.70	500	115	115
N-59M	86.50	1000	115	115
N-52M	38.70	350	95 to 130	115

With switch and meter for primary voltage control. Detachable cord.

Write for Catalog TR-56

TRIAD TRANSFORMER CORP
4055 Redwood Ave., Venice, Calif.

LAFAYETTE SENSATIONAL VALUES!

IN COMPLETELY WIRED TEST EQUIPMENT at LESS than the PRICE of KITS!

LAFAYETTE SIGNAL GENERATOR

NEVER BEFORE HAS A COMPLETELY WIRED AND TESTED INSTRUMENT OF SUCH ACCURACY AND QUALITY BEEN OFFERED AT SUCH A PRICE!

- **FREQUENCY 120 KC TO 260 MC**
- **120 KC TO 130 MC ON FUNDAMENTALS**
- **LABORATORY ACCURACY AND QUALITY**

22.50

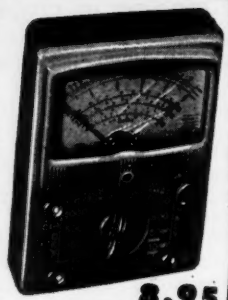
A completely wired and tested instrument not to be confused with units sold in kit form at almost the same price, but with a quality and accuracy of instruments 3 to 4 times its price. Six overlapping ranges generate signals of 120KC — 320KC, 320KC—1000KC, 1MC—3.2MC—11MC, 11MC—38MC and 37MC—130MC all on fundamentals with calibrated harmonics from 120MC to 260MC. Selector switch gives instant choice of ranges. Switch gives choice of internal modulation of 400 CPS or use of any external source at other frequencies. For audio testing the 400 cycle signal can be used separately. Outputs are unmodulated RF, modulated RF and 400 CPS audio. RF output is in excess of 100,000 microvolts and jacks are provided for choice of either high or low RF output. Stability is insured by special circuit design. Has a fine adjustment RF control. AF output is 2-3 volts. AF input is 4 volts across 1 megohm. Large clear 5 inch etched dial plate and pointer are protected by transparent plastic bezel. Common AF terminals for EXT-MOD input and INT-AF for audio tests eliminate need for special AF output connectors. Machine engraved panel lettering. Handsome gray metal case with carrying handle. Measures 6½" x 10" x 4½". Comes complete with pair of leads. AC line cord and plug. Operates on 105-125V 50-60 cycle AC. Shpg. wt., 8 lbs.

LAFAYETTE LSG-10 SIGNAL GENERATOR **22.50**

NEW POCKET AC-DC VOM MULTITESTER

2,000 ohm per volt Sensitivity on both DC and AC

160 ua 3" METER
1% PRECISION RESISTORS
SILVER CONTACT SELECTOR SWITCH



FULL SCALE RANGES

DC Volts: 0-10; 0-50; 0-500; 0-1000 Volts — *AC Volts:* 0-10; 0-50; 0-500; 0-1000 Volts—*DC Current:* 500 ua and 500 ma — *Resistance:* 0-10K; 0-1 Meg — *Decibels:* —20 to +22; +20 to 36 db (0 db — 0.775 V)—*Capacity:* 250 mmfd to .2 mfd—.005 mfd to 1 mfd—*Output Ranges:* 0-10; 0-50; 0-500; 0-1000 volts

8.95

Best Buy in America! A very accurate and sensitive VOM. This Multitester is a complete instrument (not a kit) with high quality and sensitive 160 microamp meter; 2000 ohm per volt on both AC and DC. Single selector switch, 1% precision resistors, 3" meter. Features extreme versatility, accuracy and ruggedness. In attractive plastic front panel, with metal bottom for ruggedness and shielding. First capacity range requires 50 volt AC source. Second capacity range requires 10 volt AC source. Size 4¼"x3½"x1⅝". Complete with test leads and batteries. Shipping weight 4 lbs.

RW-27A ..... Complete **8.95**

NEW! LAFAYETTE CAPACITANCE-RESISTANCE TESTER WITH "IN-SET QUICK CHECK"

COMPLETELY WIRED AND TESTED

- **TWO INSTRUMENTS IN ONE**
- **CHECKS ELECTROLYTIC, PAPER, MICA AND CERAMIC CONDENSERS**
- **4 DIRECT READING CAPACITY SCALES FROM .00001 MFD TO 1000 MFD**
- **CHECK FOR OPEN SHORTS, LEAKAGE AND INTERMITTENTS**
- **2 RESISTANCE RANGES FROM 100 TO 5 MEGOHM**

34.50

Here is a "must" for servicemen and lab technicians. A completely self-contained AC operated capacitance and resistance bridge, plus a quick check for in the set testing. Large 5 direct reading scale has 4 ranges of .00001-.005 MFD, .001-.5 MFD, .1-50 MFD and 20-1000 MFD. Resistance ranges are 100-50,000 OHMS and 10,000 to 5 megohm. Quick check feature enables you to check capacitors for shorts, open or intermittent while in circuit—no need to remove them from the set till you're sure they need replacement. Leakage test switch gives you choice of 25, 150, 250, 350 or 450 volts for checking leakage under correct potential. Separate power factor control with continuous settings from 0 to 50%. Operation is simple and accurate, using a magic-eye tube as the null detector. Attractively finished steel case with etched panel and rounded corners, measures 14½"L x 8¼"H x 5"D. Shpg wt. 19 lbs.

MODEL LC-4 ..... NET **34.50**

HIGH SENSITIVITY 20,000 OHM PER VOLT DC 10,000 OHM PER VOLT AC MULTITESTER

LOOK AT THESE FULL SCALE RANGES!

D.C. Volts: 0-6; 0-30; 0-120; 0-600; 0-1200; 0-6000 Volts — *A.C. VOLTS:* 0-6; 0-30; 0-120; 0-600; 0-1200 Volts — *RESISTANCE:* 0-10K; 0-100K; 0-1 Meg; 0-10 Megohms—*D.C. CURRENT:* 0-60 Microamp; 0-6; 0-60; 0-600 Milliamps — *DECIBEL:* —20 to +17 db (0 db—0.774V) — *CAPACITY:* .0001-.01; .005-.15 mfd — *INDUCTANCE:* 20-2000 millihenry —*OUTPUT RANGES:* 0-6; 0-30; 0-120; 0-600; 0-1200 Volts

19.95

The new Lafayette high sensitivity Multitester is a complete instrument (not a kit). In addition to its unusual sensitivity of 20,000 OHMS PER VOLT ON D.C. AND 10,000 OHMS PER VOLT ON A.C., and the extraordinary number and scope of its ranges, it is packed with features that would make it cost at least twice as much if made in this country. Uses 1% precision resistors, silver contacts on selector switch, 35 ua 3" meter. Dependable, rugged and accurate. Even the test leads are heavy duty with high voltage insulation. Voltage source required for low capacity range is 120V A.C., for high range capacity and inductance scale is 6V A.C. Attractive plastic front with metal bottom. Size 6¼"x4½"x2½". Complete with batteries and leads. Shipping weight 4½ lbs.

RW-30A ..... Singly, Each **19.95**
In lots of 3, Each **19.25**

NEW! LAFAYETTE CAPACITOR-RESISTANCE TESTER

COMPLETELY WIRED AND TESTED

COMPLETELY WIRED AND TESTED

21.50

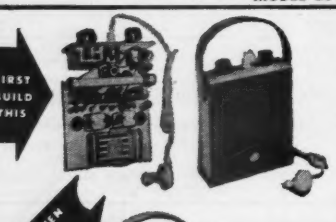
- **CHECKS ALL TYPES OF CONDENSERS FOR CAPACITY, LEAKAGE, OPEN SHORTS OR INTERMITTENT CONDITION**
- **DIRECT READING SCALES FROM .00001 TO 1000 MFD AND 100 TO 5 MEGOHMS**

A stable and accurate bridge type circuit measures capacitance in 4 ranges of .00001-.005 MFD, .001 to .5 MFD, .1 to 50 MFD and 20 to 1000 MFD. Two resistance ranges of 100-50,000 and 10,000 to 5 megohms. Check leakage under actual load with choice of 25, 150, 250, 350 or 450 volts available by selector switch. Power factor control from 0 to 50%. Checks for leakage, open, short, or intermittent operation. All readings taken directly off scales after setting magic eye to maximum. Completely self-contained power supply. Attractively finished steel case with rounded corners and etched panel. Operates from 110V AC. Size 9⅜"L x 7⅞"H x 5¼"D. Shpg. wt. 10 lbs.

MODEL LC-15 ..... NET **21.50**

4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION

POCKET SIZE 4 L x 3-5 16 W x 1 D BUILT-IN ANTENNA REQUIRES NO EXTERNAL ANTENNA OR GROUND!



Lafayette engineers have designed this fascinating 4-transistor superhet receiver kit in a unique and interesting form. It is, by itself, a completely self-contained, pocket sized personal portable set which operates a miniature earpiece so only you can hear; by plugging into the KT-96 kit listed below, it is instantly converted to a full 6-transistor home radio, complete with speaker for the entire family to enjoy. Circuit features use of 4 transistors (2 high frequency and 2 audio type) plus a germanium diode, 2 I.F. stages and built-in high gain ferrite core and antenna. The result is a sensitive, stable and selective set covering the entire broadcast band. Requires no outside antenna or ground connection. The kit is furnished complete with transistors and all parts, including battery and chassis already drilled and punched. The earpiece and carrying case are accessory items, not supplied. All necessary pictorial and circuit diagrams are furnished with simple, easy-to-follow instructions.

KT-94 —Kit, shpg. wt., 2 lbs. ..... Net **19.95**
MS-311—Leather Carrying Case ..... Net **1.95**
MS-260—Super power dynamic earpiece ..... Net **3.95**

2 TRANSISTOR PUSH-PULL OUTPUT KIT WITH SPEAKER SET CONTAINED IN BEAUTIFUL PLASTIC CASE

- **CONVERTS 4-TRANSISTOR KIT INTO A 6-TRANSISTOR HOME RADIO WITH SPEAKER**

Add a completely transistorized push-pull audio stage to your 4 transistor receiver. Complete stage including speaker and case measures only 9" H x 2¾" W x 1⅝" D. Plugs right into 4 transistor kit above. Converts your 4 transistor set to a 6 transistor plus diodes superhet receiver. Performance equal or superior to commercially wired sets selling at more than twice the price. Kit includes 2 transistors, 2 transformers, 2¼" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams.

KT-96—Shpg. wt., 1 lb. ..... Net **11.50**

LAFAYETTE RADIO DEPT RL-1

JAMAICA 33, N. Y. 165-08 Liberty Ave. Write for FREE Bargain Packed Catalog!

100 SIXTH AVE., NEW YORK, N. Y.
BOSTON, MASS., 110 Federal St.
PLAINFIELD, N. J., 139 West 2nd St.
NEWARK, N. J., 24 Central Ave.
BRONX, N. Y., 542 E. Fordham Rd.

FREE! LAFAYETTE CATALOG

ELECTRONIC CATALOG PACKED WITH MONEY SAVERS

Packed with the largest selection of Electronic, Radio and T.V. Parts, and equipment. PA, Hi-Fi systems, tubes, antennas, Transistor Kits, parts and components. Test Equipment, new build your own kits, tools, books, Microscope, drafting equipment, Binoculars, Telescopes, All Radio, TV and Ham supplies — ALL AT GREAT SAVINGS — For the economy minded servicemen, dealer, engineer and technician. CHUCK FULL OF BUYS! SEND FOR YOUR FREE COPY TO-DAY.

35 WATT HI-FI AMPLIFIER KIT WITH METERED OUTPUT AND 4 PUSH-PULL PARALLEL NEW EL84 TUBES

New Lafayette high power amplifier kit with a host of features not in any other single amplifier. Calibrated output meter permits use as either a recording or reproducing amplifier. EL84 power pentodes provide high peak power and low distortion required for better audio quality. Features exceptional control versatility and ample inputs for all associated custom hi-fi equipment. DC operated preamp filaments and balancing adjustment to minimise hum. Meter can be switched to indicate either recording voltage or output level of amplifier. Features rumble filter, loudness control, separate bass and treble controls, silencing switch, speaker selector switch, output balancing adjustment and monitoring jack.

SPECIFICATIONS

FREQUENCY RESPONSE: ± 1 db 20-40,000 cps. **HUM:** 85 db below rated output. **POWER OUTPUT:** 35 watts with 4% total distortion at full rated output. **INPUTS:** TV Sound, Radio, Magnetic Phono, Crystal Phono, Tape. **OUTPUT IMPEDANCE:** 4, 8 and 16 ohms; high impedance for tape recorder. **TUBE COMPLEMENT:** 3-12AX7, 1-12AU7, 4-EL84, 1-5U4. **FEEDBACK:** Negative feedback loops virtually eliminate distortion. **POWER:** 117V, 60 cps, 80/150 watts with auxiliary power receptacles. Removable escutcheon. Size 15⅛" L x 9⅝" D x 4¾" H.
A combination of high power, high fidelity, gleaming beauty and advanced engineering features unmatched at even twice the price. Supplied in complete kit form with simplified easy-to-follow instruction sheets. Shpg. w., 25 lbs.

KT-115—Complete kit, ...Net **59.50**

LAFAYETTE'S FM-AM TUNER KIT

- **SIMPLIFIED DETAILED INSTRUCTION MANUAL**
- **MEETS FCC REQUIREMENTS FOR RADIATION**
- **GROUNDED GRID TRIODE AMPLIFIER**
- **ARMSTRONG FM CIRCUIT WITH FOSTER-SEELEY DISCRIMINATOR**
- **AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL**

The excellence of its design and the quality of its components combine to provide this compact high-fidelity FM-AM tuner with superb characteristics normally found in units costing several times as much, and with performance unbelievable at this low price. Features Armstrong FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counterweighted mechanism. AFC defeat circuit combined with tuning control. Attractive etched copper-plated and lacquered finish.

SPECIFICATIONS

FREQUENCY RANGE: FM, 88-108 MC; AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms; AM, Ferrite loopstick and high impedance external antenna. **CONTROLS:** 2—3 function control for AM, FM, PHONO, TV and a tuning/AFC defeat control. **DISTORTION:** Less than 1% rated output. **FREQUENCY RESPONSE:** FM, ± .5 db 20 to 20,000 cps; AM, ± 3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 μv for 30 db quieting; AM, Loop sensitivity 80 μv/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down — 375 KC FM discriminator peak to peak separation; AM, 3 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation. **TUBE COMPLEMENT:** 2-12AT7, 1-6BA6, 1-6BE6, 2-6AU6, 1-6AL5 plus 1-6X4 rectifier. **SIZE:** 5¼" high x 9⅝" wide x 9½" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Less metal case. Shpg. wt., 9 lbs.

KT-100 Complete kit, less cage, ...Net **34.95**
LT-10 —Completely wired..... Less metal case, ...Net **52.50**
ML-100—Metal cage for above, shpg. wt., 3 lbs.....Net **5.00**

New! HIGH FREQUENCY TWEETER WITH ACOUSTIC LENS

DIRECT IMPORTATION MAKES THIS PRICE POSSIBLE!

14.95

- **FREQUENCY RESPONSE FROM 2000 CPS TO BEYOND AUDIBILITY**
- **LOUVERED ACOUSTIC LENS FOR UNIFORM SOUND DISPERSION**
- **HANDLES 25 WATTS OF POWER**
- **PRICED EXCEPTIONALLY LOW**

New high frequency tweeter featuring a louvered acoustic lens for uniform sound dispersion and capable of handling up to 25 watts of distortion-free power. The directional tendency of high frequency notes is overcome by the natural wide dispersion angle of the short horn and the acoustic lens which disperses and radiates the high notes smoothly throughout the entire listening area. The lens is detachable for panel mounting, with a separate base for the tweeter furnished for external mounting where desired. Aluminum voice coil has 16 ohms impedance. Size: 4¼" long x 3" diameter, lens extends 2½". Requires a crossover network, preferably one with a level control, such as the LN-2. With full instructions. Shpg. wt., 5 lbs.

HW-7 .....Net **14.95**

METAL-CASED CONE TYPE HI-FI TWEETER

FREQUENCY RESPONSE 2000-16,000 CPS • HANDLES 20 WATTS OF POWER

Highest quality cone type high frequency tweeter having a range from 2000 to 16,000 cycles. Especially efficient at higher end of audio spectrum where other cone type tweeters tend to lose clarity and volume. Entirely closed in a metal case with a base so that it can stand by itself or be mounted on a flat surface with mounting bracket supplied. Rated to handle 20 watts of power. A crossover network is required; the Lafayette LN-2 is ideal. Voice coil impedance 8-16 ohms. Size: 3⅛" x 2⅛" x 3" Diam. Shpg. wt., 3 lbs.

5.95

HK-3 .....Net **5.95**

CROSSOVER NETWORK

• CAPACITIVE-INDUCTIVE NETWORK WITH CROSSOVER AT 2000 CPS
• BUILT-IN LEVEL BRILLIANCE CONTROL

8.75

The frequencies above 2000 cycles are channeled to the high frequency tweeter by means of the high-Q inductance and capacitance comprising this efficient crossover network. The highs and lows are brought into acoustic balance by means of a continuously variable level-brilliance control. Control has a 2½ ft. long cable for remote mounting. Network matches 8-16 ohm speakers with insertion loss reduced to a minimum. Enclosed in metal case 6" L x 2⅝" H x 2⅝" D. With full instructions. Shpg. wt., 5 lbs.

LN-2 .....Net **8.75**

2 WAY SPEAKER SYSTEM 40-16,000 CYCLES

A modest budget need no longer limit your HI-FI aspirations. The system consists of the G.E. 12" woofer with heavy 14.5 oz. alnico V magnet and 1¼" aluminum voice coil rated at 25 watts; the new metal cased HK-3 cone type tweeter; and the LN-2 crossover network with level and brilliance control. Both tweeter and network are described on this page. The complete 2-way speaker system covers the frequency range 40-16,000 cycles. Shpg. wt., 16 lbs.

SY-87—Complete System.....Net **27.50**

SY-88—Complete System, same as above except the HW-7 Tweeter with acoustical lens is supplied instead of HK-3. Shpg. wt., 20 lbs.....Net **36.50**

New! LAFAYETTE Mail Order Center

Lafayette Radio
DEPT RL-2
165-08 Liberty Ave.
JAMAICA 33; N. Y.

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ADDRESS _____
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ZONE _____
STATE _____

SEND FREE LAFAYETTE CATALOG

CUT OUT AND MAIL TODAY!

"Anyway you look at it . . . this is DYNAMIC!"

FILTENNA

Manufactured by . . . DYNAMIC ELECTRONICS—NEW YORK, INC., FOREST HILLS, LONG ISLAND, NEW YORK

SATIN BRASS, SATIN COPPER and SATIN CHROME FINISHES.

$18.95 List

Beautiful!

T.M. REG. Patents Pending.

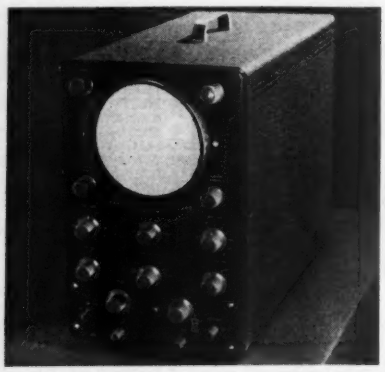
The first truly Electronic indoor TV Antenna to give you clear filtered reception . . . with the EXCLUSIVE built-in HI-PASS FILTER

What's New in Radio

5" SCOPE KIT

Heath Company of Benton Harbor, Mich. has recently released a new and improved build-it-yourself oscilloscope circuit.

The Model OM-2 retains the outstanding features of its predecessor

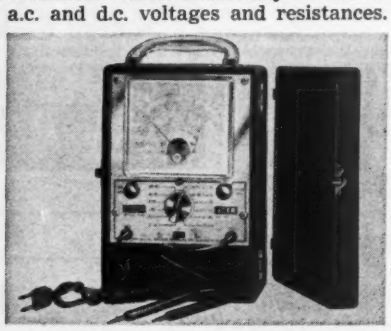


model but provides wider vertical frequency response, extended sweep-generator coverage, and increased stability. A new tube complement and improvements in the circuit make these features possible.

The vertical frequency response is essentially flat to over 1 mc. and down only 1½ db at 500 kc. The sweep-generator multivibrator functions reliably from 30 to 200,000 cps, almost twice the coverage of the previous model. The deflection amplifiers are push-pull and modern etched circuits are employed in critical parts of the design.

ANCHOR V.T.V.M.

Anchor Products Company, 2712 W. Montrose Ave., Chicago 18, Ill. has recently introduced a new vacuum-tube voltmeter which accurately measures a.c. and d.c. voltages and resistances.



The instrument has a separate 3-volt a.c. scale for measuring low voltages, zero centering for TV and FM alignment, and a range of 30 cps to 100 mc.

The Model V-500-VTVM uses no batteries. Selection of both range and function is made through a single control. An "on-off" indicator light, polarity reversing switch, db scale, overload protection, and full bridge circuit are additional features.

For literature on this factory wired and tested instrument, write the manufacturer direct.

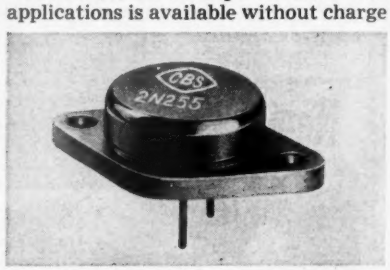
TRANSISTORS FOR HOBBYISTS

CBS-Hytron of Danvers, Mass. has recently introduced a new line of low-priced power transistors designed especially for use by experimenters and hams.

The new types 2N255 and 2N256 are *p-n-p* alloy-junction germanium types which have high power-handling capability coupled with high current amplification. Electrically, the two units are similar. The primary difference is that the 2N255 is intended for use with 6-volt supplies while the 2N256 is for 12-volt supplies.

Each unit is hermetically sealed for increased protection and will give years of service when operated within maximum ratings.

A booklet on *CBS* power transistor applications is available without charge



by writing the company's Semiconductor Operations at Lowell, Mass. Please specify Bulletin PA-16.

GENERAL PURPOSE FLUX KIT

Alpha Metals, Inc., 56 Water St., Jersey City, N. J., has revamped its flux assortment and is now offering a newly revised general purpose flux kit which contains 16 of the most recently advanced fluxes for electronic assemblies, printed circuits, tinning and hot solder dipping, stainless steel soldering, and aluminum soldering.

The kit is arranged in compartments with full details on the flux and its application printed in the corresponding position on the cover of the box.

COLOR TV SAFETY DEVICE

General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill., has announced the availability of a newly developed safety device for color TV set servicing.

Known as the "Color TV Interlock Cheater," the tool is said to render technicians completely safe when the back of the set is removed for repairs.

OLSON RADIO FOR GREATEST BUYS IN RADIO AND TV SUPPLIES

$47.16 Less Than Regular Price!
HIGH FIDELITY SYSTEM

ALL FAMOUS BRANDS

GARRARD GENERAL ELECTRIC
Monarch NORELCO • ARGOS

During this sale only

Complete outfit shpg. wt. 70 lbs.
Stock No. AS-235 only

$119.95

While They Last!

You get all of the above nationally advertised high-fidelity components, ready to play. Not a kit. Just mount the speaker in the console enclosure, plug units together and you have "living sound" in 5 minutes. Because Olson is able to operate efficiently we can make a value like this possible.

Ⓐ The Argos Bass Reflex Console Speaker enclosure model AD-1 has an interior which is acoustically padded and is finished in richly grained mahogany plastic material. Made of heavy 5 ply wood, ½" thick. Has smart 2-tone woven plastic grille. Overall size 23½" H x 19⅛" W x 13½" D.

Ⓑ The Norelco 8" Model 9770M High Fidelity Speaker is equipped with coaxial twin cones of the "FRS," (full resonance series). Delivers full bass and treble to 19,000 cps. Made by Philips of Holland for the carriage trade exclusively.

Read What You Get

National Horizon 10 Amplifier with built in pre-amp...	$79.95
Garrard RC121 Automatic 4-Speed Changer with General Electric RPX-050A Cartridge and mounting base.....	$55.21
Noreico 9770M Twin Cone Speaker with Ticonal Magnet.	$9.90
Argos AD-1 Bass Reflex Console Speaker Enclosure....	$22.05
Regular Net Cost	$167.11

Ⓒ The new Garrard RC121 Automatic 4-Speed Changer is equipped with a 4-pole motor and switch for playing records manually. Has a plug-in head with General Electric RPX-050A variable reluctance pickup, 2 "Clip-in" sapphire needles, line cord, output cable and mahogany mounting base.

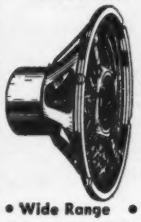
Ⓓ The National Horizon 10 Amplifier has a pre-amplifier built in. Multi-position switch compensates for any record regardless of make or condition. Features include dual wide rang bass and treble controls; input for any tuner or tape recorder; response 1 db from 20 to 20,000 cps. 15 watt max.

45 RPM SPINDLE

For above Garrard changer, if desired, Stock No. RP27..... **$3.43**

★ CLOSE-OUT!
12-inch CO-AXIAL SPEAKERS

- *Thousands have been sold for $13.95*
- *Must make room for the new model*



While They Last

$10.88

Stock No. S-226

• Wide Range • 35 to 15,000 cps.

Our regular $32.50 retail hi-fi speaker, 20 watts. We are closing out this speaker and making room for the new model. Order one or more of these fine speakers during this sale and save money. Each speaker consists of a 12" woofer section driven by a heavy magnet. This part delivers the bass notes. The built-in 3½" tweeter section is driven by its own voice coil and magnet system and this part delivers the treble or high frequency notes.
The high pass filter is built into the speaker and the entire combination gives you tones you never dreamed possible. Only two wires to connect to any radio or amplifier. Voice coil impedance 8 ohms. Shpg. Wt. 10 lbs.

SPEAKER and BAFFLE COMBINATION

• *Unbelievable Value*

Reg. $14.50 List
You get both for
$4.95

Stock No. AS-121

Deluxe modern design sloping front walnut finished baffle. Rounded corners, top and bottom, attractive grille cloth. Speaker is Olson's most popular 8" model. Equipped with Alnico 5 magnet and will deliver 7 watts. Voice coil impedance 3.2 ohms. Shpg. Wt. 7 lbs.

3-SPEED PHONO MOTOR AND TONE ARM

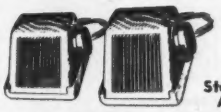
Worth $9.50
You Get Both For
$5.78

STOCK NO. AS-205

Genuine Monarch (Made in England) 3-speed, 33⅓, 45, and 78 RPM motor and 8" turntable. Handy lever switches from one speed to another. Rim drive, rumble free.
Tone arm is the famous Webster with Turn-over crystal cartridge. 3 volt output. Equipped with 3 mil and 1 mil osmium tipped needles. 50-7000 cps. Arm is counter-balanced. Shpg. Wt. 5 lbs.

BEL-COM INTERCOM

An Unbelievable Price
Thousands Sold at $9.98



Stock No. AM-22

$3.87 Set
Special
3 Complete Sets $10.00

The Bel-Com is a self-powered system using batteries. Requires no connection to household currents. Just lift mike off hook, press button on mike and talk! Party at other end can talk back by lifting their mike and pressing button. Can be used with up to 1000 ft. of cable. Complete with 25 feet of 3 conductor cable, 4 batteries and instructions. Cabinet molded of Dow 475 High Impact Styron in colorful Burgundy Red. Speakers are 4" PM and mikes are carbon button gold diaphragm. Attractively packed.

EXTRA CABLE FOR BEL-COM

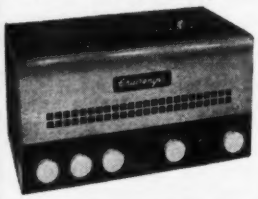
100' 3 conductor Stock No. W-105..$1.50
250' 3 conductor Stock No. W-106.. 3.50

HOW TO ORDER

Mail your order to 277 E. Market St., Akron 8, Ohio. Send remittance with order (add for postage 5c for each dollar's worth ordered—10c for each dollar's worth if you are more than 1000 miles away). OLSON REFUNDS EVERY CENT NOT USED. Or—send no money—we'll ship C.O.D. and you pay mail or expressman for merchandise and postage. ALL MERCHANDISE 100% GUARANTEED, PLEASE —MINIMUM ORDER $5.00.

BOGEN 30 WATT AMPLIFIER

With Tubes and Cage

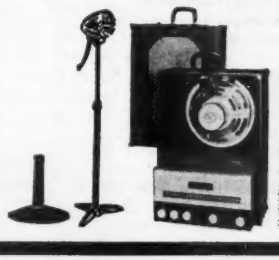


Regular $99.50 List
Stock No. AM-1
Olson's Special Price
$58.05

The famous Bogen "Challenger" 30 watt amplifier with exclusive SELECTONE tone corrector. Tone switch is calibrated for (1) "Deep Bass" for popular records, (2) "Mellow" for elimination of scratch on noisy records, (3) "Crisp" for ideal speech reproduction, (4) "Brilliant" which accentuates bass and treble for living presence sound.
Equipped with 2 inputs for any high impedance microphones and one input for phono, all of which can be mixed. This amplifier will handle large auditoriums or great outdoor gatherings. Can be used with up to 24 speakers. Output impedance 4, 8, 15 ohms and 70 volts. Inverse feedback circuit. UL approved. Operates on 115 volt ac cy. Shpg. wt. 26 lbs.

COMPLETE BOGEN PA SYSTEM

Nothing More to Buy
Stock No. AM-12



$109.53

30 watt Bogen amplifier as described left, crystal microphone with cable, desk stand, floor stand, 2-12" Alnico 5 PM speakers with 25 ft. cables and plugs and dual portable carrying case which acts as speaker baffles. Overall size of case 17 x 13 x 25. Shpg. Wt. 60 lbs.

INDOOR TV ANTENNA

All Channel—UHF—VHF

Regular $10.95 List
Stock No. AA-25 each **$2.88**
3 for $8.00

6 position switch built into base for maximum efficiency on channel being received. Three section brass elements, adjustable, tip proof base. Matches any TV set. Complete with 300 ohm lead wire. Shpg. Wt. 5 lbs.

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CHICAGO—123 N. Western Ave.
CLEVELAND—2020 Euclid Ave.
PITTSBURGH—5918 Penn Ave.
MILWAUKEE—423 W. Michigan
BUFFALO—711 Main Street

SHIELD RECORDING TAPE

Plastic base, splice-free, polish red oxide guaranteed equal to higher priced brands. Available in regular and LONGER play.

7" Reel, 1200 ft, Standard Play

Stock No. X-249, Lots of 12, ea. **$1.59**
Lots of 6, $1.79 each
Single Ea. $2.19

7" Reel, 1800 ft, LONGER Play

Stock No. X-583, Lots of 12, ea. **$2.45**
Lots of 6, $2.59 each
Single ... $2.99

ATTENTION MANUFACTURERS: If you have large quantities of surplus electronic parts you wish to sell, call or write OLSON at once. We pay top prices!

WILCOX-GAY RECORDIO TAPE RECORDER

- Automatic Keyboard
- Dual Track
- Push Button Control

Records from microphone, radio or TV set

PRICE SLASHED WHILE THEY LAST STOCK NO. AM-28

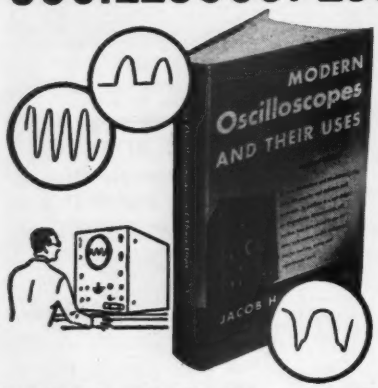
$69.95

Save money on this new 1957 Wilcox-Gay tape recorder. Beautifully styled in pale green and gold. IT's easy to get perfect recordings first time. Has built-in efficient erase system, removes old recording automatically while new recording is being made. Records 3", 5" or 7" reels.
Excellent tone quality response 55 to 8500 cps. Output jack for external speaker. At 7½" speed, 1200 ft. tape records ½ hour on each track and 1 hour overall. On 1800 ft. tape records 1½ hours overall.
Push buttons control all functions, stop, record, reverse, playback. Has tone and volume controls, redi-lite and record level lite. Shure microphone cable and plug and 300 ft. reel of tape and empty reel included. Removable lid. Size 14 x 12 x 9". Shpg. wt. 29 lbs.

OLSON RADIO WAREHOUSE 277 EAST MARKET ST. • AKRON 8, OHIO

HERE'S EVERYTHING YOU NEED TO KNOW ABOUT

OSCILLOSCOPES!



Service Any Radio-TV ever built EASIER-BETTER-FASTER

Oscilloscopes are gold mines for servicemen who learn to use them fast and accurately—and here, in a brand new, completely revised 2nd edition, is THE book that really shows you how.

In plain, easily understood language, MODERN OSCILLOSCOPES AND THEIR USES teaches you just when, where and exactly how to use your oscilloscope.

You learn how to handle tough jobs easier and faster than you may have dreamed. Every detail is clearly explained—from making connections to adjusting circuit components and setting oscilloscope controls.

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This big book is more widely used than any other of its type—because it gets right down to "brass tacks." No involved mathematics. No complicated discussions. You learn exactly what the oscilloscope is and exactly how to use it on all types of AM, FM and television service (including color)—from locating troubles in a jiffy to handling tough realignment jobs.

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. . . Contains the latest data on oscilloscopes, the handiest, most useful service instrument of all!

More Than 30 Extra Pictures!

. . . plus 50 additional pages bringing newest details on use of 'scopes in COLOR TELEVISION... Radio - TV Servicing... Industrial Electronics... Teaching...and even in atomic energy work!

PRACTICE 10 DAYS FREE!

Dept. RN-126, RINEHART & CO., Inc., 232 Madison Ave., New York 16, N. Y.

Send new 2nd edition of MODERN OSCILLOSCOPES AND THEIR USES for 10-day FREE EXAMINATION. I will then send $6.50 (plus postage) promptly in full payment or return book and owe you nothing. (*Send $6.50 with order and we pay postage. Same 10-day return privilege with money refunded.*)

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Address.....

City, Zone, State.....

OUTSIDE U.S.A.—Price $7.00, cash only. Money back if you return book in 10 days.

The new tool is plugged into the set where it permits entry of a high-voltage probe through its shell.

V.H.F. RECEIVER

Nova-Tech, Inc., 1721 Sepulveda Blvd., Manhattan Beach, Calif., has developed a new, low-cost v.h.f. receiver especially for those interested

in monitoring communications between aircraft, the military test frequencies, as well as ground control approach, tower, flight, and weather transmissions.

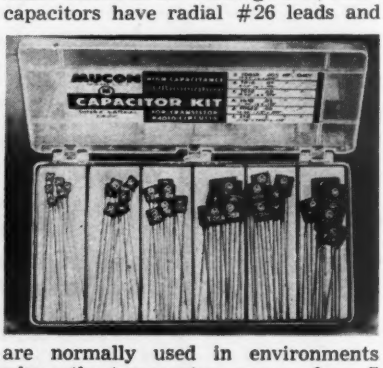
Tradenamed the "Air-O-Ear," the set has six tubes in a superhet circuit with noise squelch control, a selenium rectifier, a.v.c., coaxial tuning, drift compensation, a heavy-duty 6" oval speaker in a case measuring 7½" x 5" x 4½", and a white dial calibrated 108 to 130 mc. The unit weighs 5 pounds.

Write the manufacturer direct for full specs and price.

CAPACITOR KIT

Mucon Corp., 9 St. Francis St., Newark 5, N. J., has assembled a kit of capacitors for the convenience of engineers and development personnel working with transistor circuits.

The kit of high-capacitance subminiature ceramic capacitors includes six each of the following values: .005 μfd., .01 μfd., .02 μfd., .05 μfd., .05 μfd., and .1 μfd. These range in size from $^{13}/_{64}$" square to $^{17}/_{32}$" x $^{21}/_{32}$" maximum with thicknesses from .090" to .110" maximum. Rated at 25 working volts, these capacitors have radial #26 leads and



are normally used in environments where the temperature ranges from 5 to 40 degrees C.

Write the company for information on availability and prices.

45-VOLT SELENIUMS

Federal Telephone and Radio Company, 100 Kingsland Rd., Clifton, N. J., is now offering a new line of 45-volt selenium rectifiers in standard sizes from $^{11}/_{16}$" to 2" square.

Seven types are already in production with additional types in larger sizes to be available shortly. The cells exhibit high stability and very low reverse or "leakage" current, making them suitable for use in magnetic amplifiers. The rectifiers will permit significant savings in cost and space by reason of the fact that fewer cells will be needed to achieve a desired voltage rating.

The rectifiers are being manufactured in both commercial and radio-TV types. The company's Components Division will supply complete details on request.

FLEXIBLE POWER RESISTOR

Lectrohm, Inc., 5560 Northwest Highway, Chicago 30, Ill. has developed a new type of flexible power resistor especially for printed circuit applications.

The light weight and flexibility of these resistors offer the advantages of easy assembly and simplicity of making changes in resistance and voltage without changing the holes in the mounting board. The element is wound on a flexi-

ble Fiberglas core. The sleeving, also of Fiberglas, is heavily saturated with silicone to pass requirements for above-chassis mounting.

Currently these resistors are available in values up to 2500 ohms at 5 watts and up to 5000 ohms at 10 watts. Complete information is available from the manufacturer.

NEW RCA TRANSISTORS

The Semiconductor Division of *Radio Corporation of America,* Harrison, N. J., has announced the availability of three new junction transistors of the germanium *p-n-p* type.

The 2N218, 2N219, and 2N220 have flexible leads which permit soldering or welding into associated circuits. They correspond to the company's 2N139, 2N140, and 2N175 respectively as far as characteristics are concerned.

TV SERVICE INSTRUMENT

Philco Corporation of Philadelphia, Pa. has introduced a multipurpose portable instrument which is said to simplify the servicing of both black-and-white and color chassis CR tubes.

When the Model 8500 "Service King" is used for troubleshooting, it is connected between the receiver output cable and the cathode-ray tube without removing either unit from the cabinet. This setup permits measurement of video drive, K-G1 voltage, K-G2 voltage, and cathode current. When used with three-gun shadow-mask types of color receivers, this information is available separately on each of the three guns. A feedthrough position is provided so that the receiver output can be viewed on the CR tube.

CHRISTMAS BARGAINS

$135.00 Delco AUTO RADIO

9-TUBE Select-O-Matic

Ideal for Cars, Boats, Trucks, Tractors Farms, Summer Camps
Push-pull 6V6 Output! • 9 Tube Circuit
Extended Range 6" x9" PM Speaker
Covers Full Broadcast Range
Volume, Tone and Sensitivity Controls
Signal Seeker and Manual Tuning Too!

6 VOLTS
With tubes, less escutcheon.

While They Last
COMPLETE
Special Close-Out **$34.95** Reg. $125
SHPG. WT. 19 LBS.
Stock No. De-AR-RN-12

AMPRO "CAREER" #745 TAPE RECORDER

CONCORD'S PRICE **$97.50** COMP.

CONCORD SAVES YOU $77.70
Ampro "Career" Recorder $159.50
3 Rolls of Hi-Fi Tape .....
(1200 Ft.) @ 2.95 8.85
REG. TOTAL .168.35

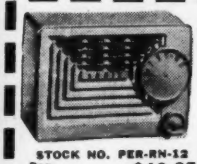
- Two Speeds, 3.75 and 7½ IPS.
- Response better than 60-11000 cps. (At 7½ IPS).
- Ful Range Tone Control.
- "Eye Tube" Indicates Recording Level
- Two Matched Speakers for Hi-Fi Response.
- Easy Action Tape Lever

Shipping Wgt. 30 Lbs.
REG. $168.35
STOCK NO. AMP-C-RN-12

FREE: 3 ROLLS OF HI-FI PLASTIC RECORDING TAPE!

PRINTED CIRCUIT RADIO

5 TUBE SET



- 5-tube superheterodyn receiver; iron core I.F.; automatic volume control; high selectivity and sensitivity; "Ferrite" type loop antenna; printed circuit components; full band coverage 540 K.C. to 1620 K.C., direct tuning station selector.
- Sturdy plastic, beautifully styled in mandarin red, ivory, platinum gray or forest green to blend with all room decorations.
- Power Supply—115 volts, 50-60 cycles A.C. or 115 volts D.C.
- Dimen.:—6½" L x 4½" H x 2⅞" D.

STOCK NO. PER-RN-12
Reg. $22.50 ..... **$12.85**

Concordia PLASTIC RECORDING TAPE

1200 Ft. NET **$1.69** each • 1800 Ft. **$2.21** each

Buy A "BAKERS DOZEN" Pay for 12 Reels—Get 13

Manufactured for Concord Radio by one of America's most highly respected Recording Tape Manufacturers. Frequency response at 7½ IPS is 40 to 15,000 cycles with extremely low distortion and maximum signal-to-noise ratio. Wound facing in. Shpg. wt 14 oz. ea.

Stock No. TE-1/RN-12.....single 600 feet reel, $1.24
Stock No. TE-2/RN-12.....single 1200 feet reel, $1.69
Stock No. TE-3/RN-12.....single 1800 feet reel, $2.21

1800-ft.	1200-ft	600-ft.
13 for $26.52	13 for $20.25	13 for $14.50
3 for $6.45	3 for $4.95	3 for $3.50

UNCONDITIONAL MONEY BACK GUARANTEE

IMPORTED BINOCULARS

12 Coated Surfaces
All Binoculars Have Deluxe Leather Carrying Case! Prisms Held Rigid with Steel Straps
40% to 50% OFF REG. PRICES

8x30 FIELD OF VISION—420 FT. at 1000 YARDS—Fig. B. Perfect ALL AROUND binoculars. Feature coated lenses, light weight alloy bodies. Center Focus. Shipping Wgt. 3 lbs.— **$17.50**
Stock No. B1-RN-12.....

7x18 FIELD OF VISION—300 FT. at 1000 YARDS—Fig. D. Here's the right glasses for use at RACE TRACK, for ALL SPORT USE, and at the OPERA or THEATRE. Center Focusing. Shipping Wgt. 2 lbs.—Stock No. B2-RN-12..... **$16.69**

7x35 FIELD OF VISION—300 FT. at 1000 YARDS—WIDE ANGLE FIELD OF VISION—499 FT. at 1000 YARDS—Fig. A. Use these binoculars for HUNTING, BIRD STUDY, SPORTS. The wide angle glasses are wonderful for horse racing. Center Focusing. Shipping Wgt. 3 lbs. Specify Type. **$20.90**
7x35 .....
Stock No. B3-RN-12. **$29.40**
Wide Angle 7 x 35.....

7x50 FIELD OF VISION—372 FT. at 1000 YARDS—Fig. C. The most wanted binocular, will give good service in SPORTS VIEWING, HUNTING, OUTDOOR USE. Shipping Wgt. 3½ lbs. Specify Type. Center Focus **$24.90**
Stock No. B4-RN-12. **$21.45**
Individual Focus .....

8x25 FIELD OF VISION—315 FT. at 1000 YARDS—Fig. B. An ideal glass for GAME SPOTTING, BIRD WATCHING, SPORTS. Shipping Wgt. 3½ lbs. Specify Type. Center Focus..... **$17.95**
Stock No. B5-RN-12. **$15.25**
Individual Focus .....

16x50 FIELD OF VISION—183 FT. at 1000 YARDS—Fig. C. A high power binocular for LONG DISTANCE VIEWING, as PLANE SPOTTING, MARINE USE, MOUNTAIN VIEWING. CENTER FOCUS. Ship. Wgt. 3½ lbs.—Stock No. B6-RN-12 **$31.30**

Concord's HI-FI COAX SPEAKERS

15"-$19.96 8"-$8.46 12"-$10.66

HI-FI "TWIN SPEAKER" Changer Amplifier

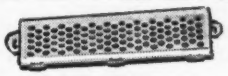
reg. $74.50

"Webcor Changer Portable"

- Webcor Deluxe 3 Speed Changer
- Full Hi-Fi Response 50-12,000 Cps. Matched Twin Hi-Fidelity Speakers
- Intermixes 10" & 12" Records
- Jamproof Feature
- Hi-Fidelity Crystal Cartridge
- Dual Stylii
- Automatic Bass Compensation
- Last Record Shuts Off Changer & Amplifier—Big!
- Custom Cabinets

Wgt.: 22 lbs.
Size: 18½" x 14¼" x 9"
Stock No. WP3-RN-12 **$46.95**

SAME AS ABOVE
But With Magic-Matic Mind. Changes speed automatically for different speed records.
Stock # WP4-RN12 **$51.95**



ISOPHON ELECTROSTATIC TWEETERS

The isophon electrostatic tweeters present a radical departure from the older less efficient high frequency speakers. Built-in baffles offer pure sound reproduction. Two types ST H B 1 round, and ST H 5/16 rectangular handle all mounting needs

Size: ST H B 7 round — Diam. 2.76", Wgt. 2 oz. ST H B 5/16 rect.—Diam. 1.97x30", Wgt. 4 oz.
Stock No. STHB516 RN-12. Shipping Wgt. 1 lb. ..... each **$3.95**

Features:
- 30 Effect
- Full Range Reproduction 7000 to 20,000 cps.
- Compact Space Saving Design
- Remarkable Brilliance of Sound

Stock No. STH B7-RN-12..... Each **$2.95**

UTAH 5" TWEETER

reg. $11.50

Response beyond audibility. Built in crossover network, 5 db. per octave attenuation. 3.16 oz. Alnico V magnet. Binding posts. 8 ohm voice coil impedance.

Tweeter B8. Shpg. wt. 2 lbs.
Faithful Reproduction of All High Frequencies. **$6.67**
2 for $12.95....ea.

GEIGER COUNTERS

A
Stock No. 6154-RN-12.
Reg. Price $39.95.
$12.95

Stock No. 6156-RN-12. Reg. Price $49.95.
$29.95

B

A
Pocket Size Geiger Counter. Our lowest priced. Measures tiny increases in radiation. Take it anywhere, includes low cost pen light battery. With earphone head set, battery, radio-active material for testing purposes and AEC booklet "Prospecting for Uranium." Aluminum case, 1½x2-5/16x4 inches. A terrific buy. Shipping weight 2 pounds. Order now.

B
"El Dorado" Geiger How to Find It." Portable instrument with ultra-sensitive features. Loud clicks on earphones, bright flashes on neon bulb make ore discovery easy. Beta-window. Halogen-type geiger tube. Aluminum case 1¾ x 4 x 7 in. Shoulder strap. Includes flashlight batteries. Weighs 2½ lbs. Shpg. wt. 4 lbs.

The Concord Custom "PLAYMATE"

3 Speed Phonograph reg. $29.50

SHATTERPROOF CASE

- Plays all three speeds, 33⅓, 45, 78 rpm.
- Trouble-free printed circuit chassis.
- High fidelity "climatized" pick-up.
- Full range P.M. speaker with Alnico V magnet.
- Famous "shatterproof" case, available in rich platinum grey or attractive pastel blue.

Dimensions: 9⅛ x 11¾ x 4¼". Shipping Wgt. 8 lbs.
Stock No. Playmate RN-12.
Reg. Price—Concord's Famous Price **$16.95**

CONCORD BOUGHT A CARLOAD TO OFFER BARGAIN PRICE! reg. $54.50

CROSLEY Famous Transistor Book Radio

- HANDSOME GENUINE LEATHER BINDINGS.
- LATEST TRANSISTORS FOR HIGH GAIN.
- MODERN PRINTED CIRCUITRY FOR PRECISION WIRING.
- SPECIAL ALNICO V SPEAKER FOR FINEST RESPONSE.
- USES LONG LIFE BATTERIES FOR ECONOMICAL OPERATION.
- INCLUDES GOLD TRANSFER KIT FOR INSCRIBING SIGNATURE OF PURCHASER.
- SIZE: ONLY 2 1/32" HIGH, 7" WIDE, 4 21/32" DEEP.
- WEIGHT LESS BATTERIES, ONLY 1 LB. 9 Ozs.

Concord's Buyers this hot item and your price is amazingly low! You will thrill at the fine tone of this radio. The handsome binding in genuine leather is made in a book form. A special automatic switch starts radio when cover is raised. Small enough to keep in your pocket. You will treasure this custom made radio through the years. Sold Nationally for $54.50. CONCORD'S LOW, LOW PRICE (Less Batteries) **$29.95**
Stock No. BUK-RAD-RN-12. Shipping Wgt. 3 lbs.
Lots of 3, $26.50 each
Batteries for above—#415, $1.75 (B). #E233, $1.68 (A)

GREAT BUY . . . CRYSTAL MIKES!!!

MODEL 101-RN-12—
Die cast case, baked on gray enamel finish. Use with floor stand, table stand, or hand held. 6 foot shielded cable, stand adaptor. For paging systems, recording, ham shacks, etc. Response better than 60-7000 CPS. Output level 49 db. Shipping wt. 1 lb.
Reg. Price $9.95.
Concord's Closeout Price—Singly **$3.95**
Lots of 3 $3.69 Each

MODEL 102-RN-12—
Handy durable plastic case tan finish. Designed as table or hand held unit. 5 feet of shielded cable. For recorders, portable equipment, mobile gear, or ham shack. Response in 60-8500 CPS. Output level 45 db. Shipping Wgt. 1 lb.
Reg. Price $8.95.
Concord's Famous Price. Each Singly **$2.99**
Lots of 3 $2.85 each

YOUR 1957 CATALOG IS READY . . . WRITE FOR FREE COPY

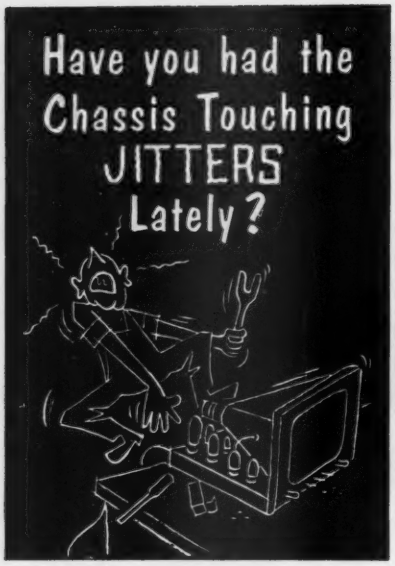
CONCORD RADIO CORP. 45 WARREN ST., N. Y. 7
DEPT. RN-12-6

RUSH THE FOLLOWING ITEMS:

1—..... 3—.....
2—..... 4—FREE CATALOG

☐ I AM ENCLOSING $.....
☐ SEND C.O.D. I ENCLOSE 20% DEPOSIT

NAME .....
ADDRESS .....



Adjust-A-Volt

LR-5 VARIABLE TRANSFORMER

with *isolated primary winding* lets you service any TV or radio set made without a chance of a "bite" no more chassis touching jitters.

$29.50

Delivery from stock of your favorite jobber.

This husky ½ KVA electro-statically shielded unit is "Must" test equipment for thousands of service men. Intermittent operating TV or radio sets are checked by dropping line voltage to 105 V or lower to detect a faulty oscillator. Also used to cook a set at 130-140 V to break down intermittent part. On any application where either isolation or a variable transformer is needed Adjust-A-Volt will do the job. Black wrinkle finish, jeweled pilot light and convenient fuse Write for new 18-page catalog listing all types and sizes.

STANDARD
ELECTRICAL PRODUCTS CO.
2238 E. THIRD ST. • DAYTON, OHIO

Other functions include CR tube testing and rejuvenating, use as a voltmeter and ohmmeter, and for setting up color receivers on installations.

"POWER VOICE" SPEAKER

Motorola Inc.'s Communications and Electronics Division, 4501 W. Augusta Blvd., Chicago 51, Ill. has announced

the availability of a mobile communications type speaker with a built-in transistor amplifier.

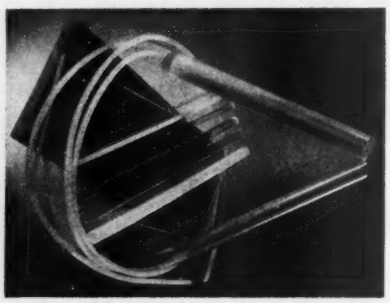
Known as the "Power Voice" speaker, the new unit provides up to ten times the audio output of standard passive speakers in mobile two-way radio installations. The speaker element has a bandpass frequency response tailored specifically for mobile service. It accents voice frequencies but suppresses ignition noise and other interference above and below the basic voice frequency range.

The unit is being offered both as an original equipment and replacement item.

PLASTICS FOR ELECTRONICS

Illumitronic Engineering, 680 E. Taylor, Sunnyvale, Cal. is now offering a complete line of plastics in various shapes and sizes developed especially for the electronics field.

Included are materials of acrylic, polyethylene, polystyrene, and phenolic plastics available as rods, tubing, and sheeting in a wide range of diameters and thicknesses. The technician can thus choose a stock piece that is close



to his requirements and modify it with a minimum of effort. The complete line is packaged for ease of handling and shipping.

Write the company for information on the entire range of items available.

RADIO KNOB KIT

Gee-Lar Mfg. Co., 400 S. Wyman St., Rockford, Ill. is now offering a new line of clock radio knobs for replacement and servicing requirements.

Four different types of clock radio knobs are being supplied, including a metal jacket (double barrier) style in gold. Others are colored plastic (single and double barrier and spring type) in six popular colors.

The knob kit, Catalogue No. 1630, contains an assortment of 25 knobs, said to meet a majority of all replacement needs. The assortment comes packed in a convenient plastic storage box.

MULTIPURPOSE "FLYBACKER"

Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill. has recently introduced a new television tester that combines both an in-circuit horizontal system analyzer and a capacitor checker.

The Model 382 will check an entire TV horizontal deflection system, in-circuit, test flyback transformers for opens and shorts, check deflection yokes for opens and shorts, and measure capacitances from 10 μμfd. to .1 μfd. by direct reading. It can also be used as a continuity meter and will

compare various flyback transformers and deflection yokes for relative *"Q"* by means of a logging scale.

The complete story on this new service shop aid is available from the manufacturer on request.

SPRING-RETURN PLIERS

Xcelite Incorporated, Orchard Park, N. Y. is currently marketing a new transverse cutter model for flush cutoff in miniature and subminiature circuits.

The No. 62 pliers feature a small coil return spring set into the body of the pliers near the leverage axis. The spring is clear of the handles permitting the use of insulating sleeves.

Designed for work in extremely small spaces, the No. 62 is a "long-nose" type with hand-honed, induction-hardened cutting edges.

PUSH-PULL-SWITCH CONTROL

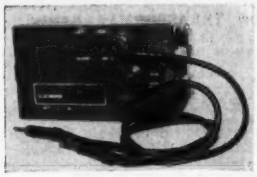
Clarostat Mfg. Co., Inc., Dover, N. H. has developed a new control which permits equipment to be turned on or off at any setting without disturbing the setting.

The new push-pull switch may be combined with any Series 47 composition-element 15/16" diameter control. The concentric shaft push-pulls for the switching action, and rotates for the control setting, both functions being independent of one another.

The new switch is available in three s.p.s.t. models in various voltages, am-

(*Continued on page* 151)

TELEPHONE & CONTROL EQUIPMENT



• CONTROL UNIT RM-53—(Pictured at left.) Used to operate radio equipment and provide remote control and intercom. of such equipment by use of the RM-52 Unit listed below. Up to ½ mile, uses 2 flashlight batt. Internal transformer has High-Low impedance Sw. and Sidetone. Also Mic. & Phone Jack & PL-55 & PL-68 Plugs.
USED: **$3.95** NEW: **$5.95**

ORDER TODAY!

REMOTE CONTROL RM-52—(Pictured at right) Can be used with RM-53 or used as a separate telephone system. Up to ½ mile. Uses 4 flashlight batt. Also can be used as a direct remote control for radio equipment. Provides bias for Mic. & Sidetone to headset. High or Low Imp. Also Mic. & Phone Jacks.

USED: **$2.95** NEW: **$4.95**

TS-13 HANDSET for RM-53 or RM-52....Used: $5.95

EE-8 FIELD TELEPHONE—Ideal for private telephone system for two or more phones, up to 17 miles. Hand ringer, generator with handset, carrying case. Uses 2 flashlight batt. Price—Used, Checked.....$14.95
WIRE—Weatherproof Twisted Pair: 500 ft. $4.75—135 ft. $1.00—2500 ft. $19.95. Per Foot at 1½¢.
COMBAT WIRE—Rubber covered W-130..$ .01 per Ft.

CLASSIFIED ITEMS:

BC-212G Amplifier—2/6C5 tubes.....NEW:	$ 1.95
BC-216 Amplifier—6F7 & 39/44.....USED:	1.50
BC-229/429 Receiver—2500-7700 KC w/Coils. U:	6.95
BC-230 Transmitter—2500-7700 KC w/Coils..U:	8.95
BC-347 Amplifier—1/6F8G tube...N: $3.95; U:	1.95
BC-357 Beacon Rec.—75 MC.....N: $4.95; U:	2.95
BC-367 Amplifier—2/6V6 tubes....N: $4.95; U:	2.95
BC-375 Transmitter .....Used:	29.95
Tuning Units f/BC-375; TU-5-6-7-8-9-10-26. U: Ea.	3.95
Cables f/BC-375/BC-191, PL-61, 64 or 59, each end: Ea.	2.75
BC-442 Antenna Relay Box—w/Cond.....New:	2.95
BC-603 Receiver FM—20-28 MC....Used:	**29.95**
BC-604 Trans.: FM—30 Watt. 20-28 MC..Used:	18.95
BC-500 Trans. & Rec.: 25 Watt, 20-28 MC. New:	59.50
BC-654 Transceiver: 3800 to 5800 KC.....Used:	34.95
BC-709 Amplifier—Battery Operated.....New:	1.95
BC-745 Transceiver: 3 to 6 MC.....Used:	14.95
BC-924 Trans. FM—30 Watt. 27-38.9 MC. New:	24.95
BC-966 IFF—160-211 MC. 13 tubes.....Used:	5.95
BC-1158 Trans.: 50 Watt. 53.3-95 MC.....New:	39.95
ID-60/APA-10 Panoramic Oscilloscope. New:	**39.95**
CD-874 Cord—f/HS-30—Low Imp., w/PL-55. U:	.59
CD-515 Cable for BC-669.....	2.75
CD-605 Cord—F/HS-30—High Imp. w/PL-54. N:	.79
CD-307 Cord—w/PL-55 & JK-26.....U:	.59
CD-318 Cord—1/PL-68, JK/48, & SW-141...U:	.89
GN-45 Handcrank Generator w/Legs & Seat...	9.95
R-4/ARR-2 Receiver—234—258 MC. w/Tubes. U:	4.95
R1/ARR-1 Receiver—Converts to 2 or 6 Meters..	2.95
RT-7/APN-1 Altimeter—440 MC.....Used:	9.95
RT-34/APS-13 Transcvr. Comp. less tubes...U:	3.95
R-74/CRW-2 Receiver—53-68 MC—6 Tubes..N:	9.95
T-121 Transmitter—3-4 MC with Coder.....	7.95
Range Beam Filter, Navy Type: $1.95; FL-8 Used:	1.49
RM-12 Radio-Telephone, Remote Control..Used:	19.95
RM-13 Telephone, Remote Control. N: $24.95; U:	19.95
RM-21 Remote Control Box for BC-669.....	4.95
SCR-625 Mine Detector—Reconditioned.....	39.95

SCR-522 Transceiver: 100-156 MC....Used:	$34.95
Rec. Chassis only.....w/Tubes:	19.95
Less Tubes:	9.95
Trans. Chassis only.....w/Tubes:	22.50
Less Tubes:	9.95
Schematic & Conversion Information only..	2.50

Sound Powered Head & Chest Set—Checked....	3.95
Sound Powered Head & Handset f/Mark II. Used:	2.95
TS-9 Handset w/switch. No Plugs: New:	5.95
Used:	3.95
TS-13 Handset w/switch. PL-68 & PL-55. Used:	5.95
HS-30 Headset—Hearing Aid Type.....L. N.:	1.50

SCR-625 Famous ARMY
MINE-DETECTOR

For Prospectors, Miners, Oil Companies, Plumbers, etc. Portable unit for locating all types of buried metal objects up to 24" or more depending on size and ground condition. Detection by means of a tone. Packed in a chest. Operating weight approx. 15 lbs. Shipping wt. approx. 40 lbs. Complete with batteries **$39.95**

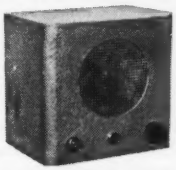
WRITE US YOUR REQUIREMENTS:
Whatever your needs in Generators, Blowers, Inverters, Motors, etc.—write us. Chances are we have it!

RADAR TRANS.

Transmitter Frequency 143 to 194 MC. using one 3A5 Tube. In plastic case 4½" x 11½" mounted top of 58" Telescoping Antenna with 14" Dipole. Battery Case for holding 2/BA-30 1½ V. & BA-38 103½ Volt "B." Has on & off Sw. Tel. Ant. mounts side of batt. case.
Price: **$4.95**

COMMAND EQUIPMENT

	USED:	NEW:
550 to 1500 REC., Navy.....	$14.95	$19.95
550 to 1500 REC., Navy, w/Ant. Loop Sw.		24.95
1.5 to 3 MC. REC., Navy.....	9.95	
3 to 6 MC. REC.—BC-454.....	9.95	
6 to 9 MC. REC.—BC-455.....	7.95	
100 to 156 MC. REC.—R-28.....	10.95	18.95
2.1 to 3 MC. TRANS., Navy.....	7.95	9.95
3 to 4 MC. TRANS., Navy.....	5.95	
4 to 5.3 MC. TRANS.—BC-457.....	4.95	
5.3 to 7 MC. TRANS.—BC-458.....	4.95	
7 to 9 MC. TRANS.—Navy.....		7.95
100 to 156 MC. TRANS.—T-23.....	14.95	



POWER SUPPLY
110 V. For Army/Navy COMM. RECEIVERS

Eliminates set conversion. For use w/BC-453-454-455-946 or any sets requiring 24 V. @ 1 A. & 250 V. @ 50 MA. Ready to use: has 4" speaker, volume control, CW and on-off switches. Complete with cord and plug f/rec.
Price....NEW: **$18.95**

FM RECEIVERS AND TRANSMITTERS

27 to 38.9 MC. FM RECEIVER

Four Pre-selected Channels & Squelch Circuit. Complete with 16 Tubes and Speaker. Set size: 6¾" W x 11½" H x 11½" D. Power required 12 or 24 VDC & 275 VDC 150 MA. BC-923 RECEIVER—Used, Checked $34.95
12 V. DYNAMOTOR For BC-923:
New: $5.95; Used: $3.95
A.C. POWER SUPPLY For BC-923.....$22.50
KIT of Parts & Wiring Diagram for BC-923....$17.50

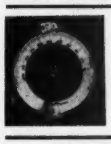
27 to 38.9 MC. FM TRANSMITTER

30 Watt companion to BC-923 Receiver. Four Pre-selected Channels, Voltage regulated M O control, using 2/815, 2/6SJ7, 1 each 6SL7, 6V6, 6J5, 6AG7, & VR-150 Tubes. Size: 11" x 11" x 18". Voltage required: 12 or 24 VDC & 400 VDC @ 400 MA.
BC-924 TRANSMITTER....New: $24.95; Used: $14.95
Power & Control Plug f/BC-923 or BC-924.....$1.00
Mounting Base FT-237 f/BC-923 & BC-924. Used: $9.95

BC-603 RECEIVER: 20-28 MC variable tuning, 10 Pre-Set push button channels, squelch circuit, 4" speaker; 10 Tubes: 2/12SG7, 2/6SL7, 1/6V6, 1/6J5, 3/6AC7, & 1/6H6. Prices:.....NEW: $39.95; USED: $29.95
PLUG for rear of Receiver.....$1.00
DYNAMOTOR: 12 V input; Output 220 V 80 MA—#DM-34.....NEW: $4.95; ReISSUE: $2.95
BC-604 TRANSMITTER: 20-28 MC, 30 Watt, companion to BC-603 Receiver. Crystal control, 10 Pre-Set channels, interphone communication; 8 Tubes 7/1619 & 1/1624.....USED: $18.95
PLUG for rear of Transmitter.....$1.00
DYNAMOTOR: 12 V input: Output 625 VDC 225 MA—#DM-35.....USED: $9.95
FT-237 BASE for mounting Receiver & Transmitter (No Plugs required)....USED: **$9.95**

BC-500 RECEIVER—TRANSMITTER:

FM Crystal Control on 5 channels. 100 KC separation 20-28 MC. Transmitter: 25 Watt output, 7 Tubes: 1/1625, 1/12A6, 3/12SJ7, & 2/12SA7. Receiver: 11 Tubes: 1/12SL7, 2/12A6, 3/12SA7, 3/12H6, 2/12K8, & 1/12SJ7. Dynamotor Supply: Receiver 28 VDC 1.2 A input; output 250 VDC 60 MA. Transmitter 28 VDC 4.1 A input; output 550 V 120 MA. Control Panel: For Local Control & Outlets for Remote also. Heavy duty 5" speaker. Size: 12" x 25" x 9½". **$59.50**
Weight: 65 lbs. Price.....NEW:



NATIONAL DIAL
TYPE "N" Precision 4" divided scale with decimal vernier drive 5-1 ratio. Planetary drive fits ¼" shaft, 100-0 scale.
Prices: 3 for $5.00.
Each: **$1.95**

RA-20 POWER SUPPLY

110 V. 60 cycle output 230 VDC 90 MA and 12.6 @ 2A. Size: 3¼" x 5½" x 6½".
Used, Checked **$9.95**

MICROPHONES & HEADSETS

F-1 BUTTON CARBON MIC.—(Pictured at right) High Gain—Can be used on desk, car, hand, or strapped to chest. Complete with on-off Mom.
Switch .....NEW: **$1.95**
RS-38 CARBON MIC. with PL-68 Plug .....U: $2.50
T-17 Carbon Mic.—Used, checked $3.95; N: $8.95

Sound Powered Mic., no cord, used, Checked: $1.00
HS-30 HEADSET — Hearing aid type .....U: $1.50
HS-18 HEADSET—4000 ohm. U: $1.95
Sound Powered—One headpiece only .....U: $1.00
Sound Powered Handset TS-10—Used, checked $5.95
TS-9 Handset—Push to talk Sw. No plugs. U: $3.95; N: $5.95
TS-13 Handset—Push to talk Sw. w/PL-68 & PL-55 U: $5.95

PRACTICE CODE TAPE:

SETS: INKED PAPER TAPES—For Code practice and training—for Radio Operators, Hams, Amateurs, Beginners, and Telegraphers. 15 lessons to a Set, on 16mm 400 ft. reels that can be reproduced on TG-34A and TG-10 Keyers.
Price: SET of 15 Reels in wood case **$18.95**
REELS: Lesson Reels available individually. Order by number desired, 1 thru 15.....Each: $2.00

TAPE PULLER MX-333—Used with code practice equipment to reel ⅜" paper tape as it is passed through the recorder. AC induction motor with friction drive for varying speed. Operates on 110 V. 60 cycle.....NEW: $12.95; USED: $9.95

TRANSFORMERS and CHOKES

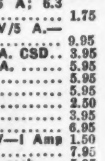
115 V. 60 CYCLE PRI. TRANS.:

600 VCT/100 MA—6.3 V/5 A.: 5 V/3 A.	$4.95
240 VCT/35 MA—24 V/.9A; 6.3 V/.6 A; 6.3 V/.3 A	1.75
1500 VCT/260 MA—6.5 V/3 A.—6.3 V/5 A.—5 V/4.5 A.	9.95
700 VCT/150 MA—5 V/3 A.; 6.3 V/4.5 A. CSD..	3.95
2500 V/.015 A.; 2.5 V/175 A.; 6.3 V/.6 A.	5.95
1890 V/12.6 MA—Tapped 2.5 V 2 A.	5.95
1100 V/80 MA—7.5 VCT/3.25 A.	5.95
720 VCT/50 MA—6.3V/2.5 A—5V/2 A.	2.50
662 VCT/110 MA—6.3V/2 A—5V/2 A.	3.95
800 VCT/300 MA—12.6V/10 A—5V/3 A	6.95
16 Volt 35 Amp. 115/230....$24.95; 24V—1 Amp	1.50
9 Volt CT—35 Amp.—Tapped 4.5 V.	7.95
12 Volt—Two separate windings—4 amp each....	5.95
5 V/2 A.; 5 V/2 A.; 5 V/2 A.; & 5 V/6 A.	2.95
6.3 V/2.1 A. and 5 V/3 A.	1.75
600-0-600 VAC—200 MA. 12.5 V. 2 A.; 12.5 V. @ 2 A.; 5 V. @ 3 A.—#H-108—Price.....	8.95
250-0-250 VAC—50 MA. 24 V. 1 A.; and 6.3 V. 1 A.—#H-109—Price	4.95

Choke—12.5 Hy/100 MA.....	$1.95
Choke—8 Hy/150 MA—200 Ohm—Open Frame....	1.25
Choke—5 Hy/150 MA—85 Ohm.....	1.50
Choke—10 Hy/250 MA—2½" x 2" x 3" Potted....	4.95
Choke—5 Hy/400 MA—4½" x 4" x 5⅝".....	4.95
"A" Choke—.1 Hy @ 1 A .7 ohm. Size: 2¼" x 2¼" x 2¼" .....Price:	1.95

METERS:

WESTON AC AMMETER:
(Pictured) In portable leather case, with Test Leads, 2½", 0-15 AC and 0-3 AC Scale..... **$5.95**



DC AMMETER HOYT: In portable metal case, with Test Leads, 4½", Fan Mirrored Scale 0-15 ADC.....$4.95
DB METER—10 to Plus 6, Westinghouse 3", MC-35 Imp. 600 ohms @ 1000 cycle..... 4.95
0-1 MA Weston 506: 2½" Rd..... 3.95
0-3 RF AMMETER IS-128: 2½" Rd.....NEW: 2.95
0-8 Amp RF w/Thermocouple IS-89: 2½" Rd.. 4.95
0-15 AC-DC—2½" Rd.: IS-122..... 4.95
0-500 MA DC—2½" Rd.: IS-22..... 4.95
0-150 V. 60 cycle: Simpson: 3½" Rd..... 3.95
0-250 MA DC—DeJur, 3" Sq..... 3.95
OUTPUT—5 Ranges, 4000 ohm Imp.—Used..... 4.95

DYNAMOTORS & GENERATORS:

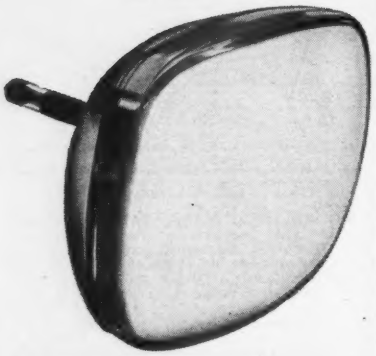
INPUT VOLTS:	OUTPUT: VOLTS:	MA.	STOCK No.	PRICES: USED:	NEW:
12 VDC	220	80	DM-34	$2.95	$ 4.95
12	225	100	D-402	5.95	8.95
12	625	225	DM-35	9.95	
12	230	80	PE-133	4.95	6.95
12	540	450	DA-12		14.95
12	230	100	DA-14		8.95
14	220	70	DM-24	4.95	7.95
14	1030	260			
	515	215	DM-42	4.95	9.95
14	375	150	BD-83	3.95	
14 VDC	330	150	BD-87	3.95	5.95
14	250	50	DM-23	6.95	8.95
14	1000	350	BD-77	14.95	
14	230	90	DM-21	6.95	
24	250	60	DY-2/ DM-32	2.95	5.95
24	250	60	PE-86		8.95
28	1000	350	PE-73	8.95	

12 to 24 VDC PM Dynamotor—Supplies 24 VDC 2 A, from 12 VDC, also 500 V 50 MA. @ 6 VDC will supply 12 VDC & 250 V 50 MA.
#0515.....New: **$4.95**

Address Dept. RN • $5.00 Order Minimum, & 25% Deposit on C.O.D.'s • Prices are F.O.B. Lima, Ohio

FAIR RADIO SALES 132 SOUTH MAIN ST. LIMA, OHIO

BEST BUILT YET



BEST FOR EVERY SET

All Tung-Sol Tubes are engineered to one standard of quality—Blue Chip Quality. Whether they're for famous set makers or leading service dealers, Tung-Sol Tubes are identical in design and performance. Tell your supplier you'd rather have Tung-Sol!

Blue Chip Quality

TUNG-SOL®

MAGIC MIRROR ALUMINIZED

PICTURE TUBES

RECEIVING TUBES

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Ga., Columbus, Ohio, Culver City, Calif., Dallas, Tex., Denver, Colo., Detroit, Mich., Irvington, N. J., Melrose Park, Ill., Newark, N. J., Seattle, Wash.

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

Manufacturer's Color Courses

(*Continued from page* 63)

attend at no charge. For more details concerning starting dates of the courses or separate copies of the book, see the manufacturer's local distributor, through whom the courses are offered, or address Electronic Education Dept., *Philco Corp.*, 2nd and Westmoreland Sts., Philadelphia 40, Pa.

Various types of courses in color under the "Television Service Clinic" program have been continuously available from the *RCA Service Co.* since 1954. An addition to this program over the past year has been the color TV workshops. These provide individual instruction to the technician by field engineers of the service company, involving actual work on color sets in the field with appropriate equipment. No charge is made for this field program, which includes specially prepared technical data. To take advantage of this and other levels of distributor-sponsored training, technicians need only keep in touch with *RCA Victor* instrument distributors, who will advise on training schedules. For those who cannot attend workshops or clinic meetings, the lecture data is available at nominal cost from Commercial Service, *RCA Service Co.*, Cherry Hill, Camden 8, N. J.

A factory school at the Batavia plant of *Sylvania Electric Products*, initially open to distributor service managers, will accept dealers and service technicians. Running for six 8-hour days, it is available at no cost to any well-trained monochrome technician who services the manufacturer's receivers. Also, a condensed 24-hour course is expected in the field subsequently. Additional information is available from Don Winters, Manager of the Instruction Group of the Service Dept., *Sylvania Electric Products Inc.*, Batavia, N. Y.

Forthcoming *Westinghouse* training is expected to follow the pattern of recent courses handled at two levels—at the factory and through the distributor. The 1-week, 8-hour-per-day factory course included practical laboratory work in small classes. Distributor training was at the rate of 4 hours per day. Also factory engineers were being trained to instruct others in the field. For news about upcoming courses, keep in touch with *Westinghouse* distributors and their service managers.

As we go to press, word has been received that *Admiral* is conducting special training schools in all cities where color transmissions are provided. The first half of the two-week course consists mostly of lectures, with the second week being devoted entirely to laboratory work.

Other manufacturers have tentative programs in the works, to go into operation when the situation warrants. These include *Crosley, Hallicrafters, Olympic,* and *Packard-Bell.* —30—

ISOLATION TRANSFORMER BARGAIN
(110V.-110V.)
Fully shielded with line cord and receptacle.
200 WATTS EACH ..... $4.75 | 300 WATTS EACH $5.50

POWER TRANSFORMER BARGAIN
Primary 115 V. 60 cy. Sec. 425-0-425V @ 200 ma., 6.3 V. @ 5 amp., 5 V. @ 4 amp. Standard mounting. 2 for $7.50 — $3.99 ea.

POWER SUPPLY KIT
Transformer as described above plus 1-shielded 6 Hy. 200 MA choke and 2 oil condensers 10 MFD, 600 VDC..... $6.75 ea.

G.E. MIDGET POWER SUPPLY
115V. 60 cy. input. Delivers 135 VDC @ 50 MA and 6.3 V @ 1 amp. Well filtered. Ideal for B eliminator for portables, pre-amps, etc. Complete with rectifier and line cord..... $3.95 ea.

OIL CONDENSER 4x4x4 MFD 600 VDC..... 95c
.001 15,000 VDC Ceramic Condenser Low-loss 2 for 99c

WESTERN ELECTRIC Stepping relay 44 steps, 6-12 Volt coil..... $4.95
FREQUENCY METER DUAL, 58-62 CPS, 48-52 CPS 3"..... $14.50

6 VOLT DYNAMOTOR 400 Volts @ 175 Mills out. Small size.... $9.95
6 VOLT DYNAMOTOR 600V @ 150 ma. $9.95

2 Mfd 4000 VDC Oil Condenser Ceramic Ins. $2.95 ea. 2 for $5.90
4" PM SPEAKER BRAND NEW ..... $1.19 ea.

115 V. 60 CY. SELSYNS
High torque. BRAND NEW in original wrappings. Made for Western Electric..ea. $5.95 2 for $9.50

Visit Our Store for Unlisted Bargains

G. E. RELAY CONTROL
(Ideal for Model Controls, Etc.)
Contains a sigma midget 8,000 ohm, relay (trips at less than 2 MA), high impedance choke, bi-metal strip, neon pilot and many useful parts. The sensitive relay alone is worth much more than the total low price of..... $1.10 Each 10 for $9.25
FREE Model Control Book with Purchase of 10.

COAX ANTENNA SWITCH
RF relay with low loss ins. Switches to either of 2 type 831R coax receptacles. Latching device removes voltage after actuated, permitting operation from 12 volts DC to 115 AC. Mounted in 6" aluminum case. Terrific Value. .....ea. $1.95 2 for $3.50

12-14 VOLT DYNAMOTOR 375 Volt at 150 Ma. with Filter ... $4.95
ANTENNA RELAY 12 Volt DC., DPDT plus extra SPST 10 amp contact. Low loss ins. .....ea. $1.39

MOBILE DYNAMOTORS
5.5 to 6 VOLT DC INPUT

OUTPUT	INT. DUTY	CONT. DUTY	FILTER	PRICE
400 VDC	275 Mills	175 Mills	with	$19.95
400 VDC	300 Mills	200 Mills	less	14.95
425 VDC	375 Mills	275 Mills	less	24.50

11.5 to 12 VOLT DC INPUT

400 VDC	275 Mills	175 Mills	with	12.95
625 VDC	225 Mills	175 Mills	less	11.75

PANEL METERS
WESTON, G.E., SIMPSON, etc.

2" METERS		3" METERS	
0-100 Microamp.	$4.95	0-10 Milliamp.	$2.95
150-0-150 Microamp	4.95	0-150 Milliamp.	3.95
0-150 Microamp.	4.50	0-200 Milliamp.	3.95
0-1 Milliamp.	3.95	0-300 Milliamp.	3.95
0-1.5 Milliamp.	2.95	0-500 Milliamp.	3.95
0-5 Milliamp.	2.95	0-150 Volts AC.	4.95
10-0-10 Amp DC.	2.95	0-15 Amps DC.	2.95
DB 0 to +15	2.95		
0-300 Volt AC.	3.95		

OIL CONDENSER BARGAINS

1 mfd 600 VDC	$ .25	8 mfd 1000 vdc.	$1.35
2 mfd 600 VDC	.45	12 mfd 1000 vdc.	1.59
4 mfd 600 vdc.	.75	6 mfd 1500 vdc.	1.95
8 mfd 600 vdc.	.95	2 mfd 2000 vdc.	1.50
10 mfd 600 vdc.	.99	3 mfd 2000 vdc.	2.25
1 mfd 1000 vdc.	.60	4 mfd 2000 vdc.	2.95
2 mfd 1000 vdc.	.75	1 mfd 3000 vdc.	1.85
4 mfd 1000 vdc.	1.25	2 mfd 10KV DC.	27.50

BIG BARGAINS IN LITTLE TYPE
Kit of 25 WIRE WOUND RES. 5 to 50 watt. $1.95
Kit of 10 TRANSMITTING MICAS..... 1.00
1 amp. MERCURY SWITCH... 59c ea.; 2 for 1.00
500 MMF CERAMIC CONDENSERS....10 for .50
15 MEG 1% METER MULTIPLIER..... 1.49
1 MFD 400VDC OIL COND.....10 for .95

Min. Order $3.00—25% with order F.O.B. New York
10 DAY GUAR. PRICE OF MDSE. ONLY

ADVANCE
ELECTRONICS COMPANY
6 WEST BROADWAY, NEW YORK 7, N. Y.
Phone REctor 2-0270

Service Associations

(*Continued from page 57*)

local dealer stakes his reputation and integrity on every job he does. His roots are right here. Possibly you know him from the veteran's group, fraternal order, or your church. His kids may go to the same school as yours. He's probably pitched in with you on the hospital and community chest drives.

"All in all, it adds up. Do business with the man you know and can trust. Always do business with your local service dealer. Look over this list for the one nearest you!"

Although TSA had this program prepared for the use of its members in the greater Detroit area, it was offered to and immediately accepted by the Michigan State Service Association when it was presented to delegates at a state meeting.

TSA plans to blanket the service shops in the Detroit area with the several dealer pieces. They will ask their local parts distributors to give out copies of the bulletins and to use the association slugs on their letters, invoices, and envelopes sent to service dealers. In addition, two-man teams, armed with complete brochures of materials, will call on owners of non-member shops to persuade them to join the Television Service Association of Michigan.

To provide additional impetus in their protest campaign against factory service, the twelve associations that are members of the Michigan State Association held mass meetings of technicians simultaneously in their cities late in October. Following the mass meetings in the individual cities, plans were drawn for a massive statewide meeting in the capital city of Jackson during November.

The material developed by the Television Service Association of Michigan can be adapted for its own use by any dealer association. The material can be applied to any association simply by inserting that association's name in the various pieces of copy and insignia. TSA announced it would make this material generally available. Information about the program may be obtained by writing to TSA of Michigan, 8225 Woodward Ave., Detroit, Mich. —30—

PICTURE HOOK

By JAMES A. McROBERTS

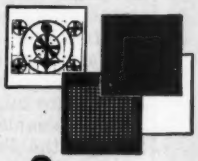
BENDING of the normally vertical lines at the top of the raster, or hook, was the complaint on the Emerson Chassis 12033. The owner supplied the information that the trouble had developed gradually over a period of a month.

The fact that the trouble was slow in developing led to the conclusion that the horizontal interference (horizontal interference is the cause of all cases of hook, either directly or indirectly) was due to a faulty capacitor that had lost its capacity. The electrolytic, C_{66}, which should have had a capacity of 10 μfd. measured a mere .8 μfd. Replacing C_{66} eliminated the trouble. —30—

SHOW ANY PICTURE or PATTERN
at any time—ON ANY TV SET

- For Servicing Black & White and Color TV
- For Merchandising and Advertising Promotions
- For Paging, Educational and Industrial Use

New MODEL 1000 B&K DYNA-SCAN
PICTURE AND PATTERN
VIDEO-GENERATOR



3 SLIDE TRANSPARENCIES ARE SUPPLIED
1. Indian Head Pattern
2. White Dot Pattern
3. White Line Crosshatch
Plus One Clear Acetate

These are broadcast quality and assure high-definition TV images. You can also transmit slides of any subject you wish.

Simplify and speed servicing with this unique, new, COMPLETE FLYING SPOT SCANNER. Produces composite video and sync signal that operates any standard VHF black and white or color TV receiver. Easily reproduces standard Indian Head test pattern or any other pattern—in home, shop or store—for proper TV set alignment; enables you to make all color TV static and dynamic convergence adjustments with stable White Dot and White Line patterns. Can be used with one or more standard TV receivers or fed into master antenna system. Reproduces from any film transparency. Transmits messages typed or written on clear acetate. Size: 16½ in. long, 10⅜ in. high, 9½ in. wide. Net wt. 28 lbs..... $199.95 NET

MODEL 950

Model 950 Dyna-Scan Pickup and RF Generator Only

Make your own picture and pattern generator. Just connect Model 950 to any properly modified 10-inch TV set which acts as your external flying spot scanner. Size: 3½ in. high, 10½ in. wide, 5 in. deep. Complete with 3 slide transparencies and 1 clear acetate. Net wt. 5 lbs..... $69.95 NET

See Your Distributor or Send For Bulletin 1000-N

B & K MANUFACTURING CO.
3726 N. Southport Ave. · Chicago 13, Illinois
Makers of DYNA-QUIK CALIBRATOR and DYNA-SCAN

B&K

TV SERVICEMEN!
Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
3619 TROOST KANSAS CITY, MO.

TAPE RECORDERS
TAPES (in Boxes or Cans) & HI-FI
EXCEPTIONAL VALUES
NATIONALLY ADVERTISED BRANDS
WRITE FOR FREE CATALOG
CARSTON 215A E. 88 St. New York 28, N. Y.

LEARN TV SERVICING
UHF—COLOR—VHF

Master the latest, up-to-the-minute TV and Color TV developments.

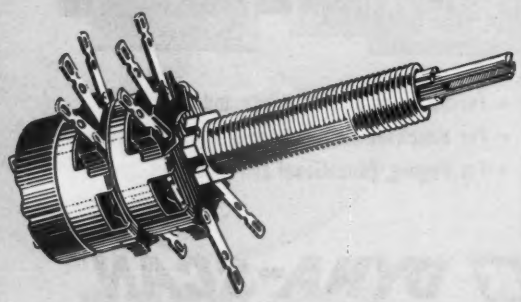
You can Earn to $5,000-$10,000 a year in TV servicing after a few short months. Education or age is no barrier. Find out how you can EARN WHILE YOU LEARN in our big Shops and Laboratories. You work with the latest equipment. Waste no time with Non-Essentials, Math or Design Theory. Complete information in our new FREE booklet. Address Dept. 12-56-R. Approved for veterans. Free Placement Service.

WESTERN TELEVISION INSTITUTE
341 W. 18th St. Los Angeles, Calif.

Dept. 12-56-R
Mail me information about training.
Name .....
Address .....

WIDEST CONTROL COVERAGE EVER ...With New IRC Dealer Parts Stocks

New IRC Dealer Parts Stocks put at your fingertips the greatest control coverage ever offered at any price. From these basic stocks of standard parts, you can now assemble most of the controls you need. You're all set for faster service . . . you're safe with IRC quality.



325 EXACT DUPLICATE CONCENTRIC DUALS

445 SINGLE CARBON CONTROLS

39 SINGLE WIRE-WOUND CONTROLS

TOTAL COVERAGE **809** DIFFERENT CONTROLS COVERING OVER 3700 MANUFACTURERS' PART NUMBERS

"QUICK-AS-A-WINK" ASSEMBLY

BASE-ELEMENT SHAFT INTERCHANGEABLE PARTS COMPLETE CONTROL

Send coupon for all the facts

Whenever the Circuit Says —

IRC

INTERNATIONAL RESISTANCE CO.

Dept. 484, 401 N. Broad St., Phila. 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licensee

Spot Radio News

(*Continued from page* 14)

amplifier, the possibility of lost personnel and aircraft should be greatly reduced.

ANOTHER NEWLY DEVELOPED TUBE, tagged a *retarding field oscillator,* was said to operate efficiently at a frequency of 70,000 megacycles; a high frequency that permits more accurate radio beam control.

Several rare metals are utilized in making these tubes. Gold is used as a solder. Silver finds various uses because it has a lower electrical resistance than more commonly obtainable materials. Sapphires are used for bearings. Additional metals used include tungsten and tantalum, both of which have very high melting points.

FLOATING ELECTRONIC INSTRUMENTATION stations will soon be plying the waters of the South Atlantic as part of the world's longest missile test range.

ARDC recently announced that contracts amounting to over one-million dollars have been awarded to California concerns to modify several government (small cargo freighter) ships. These craft will be used to receive performance data from missiles soaring over the 3000 miles of the Atlantic between St. Lucia and Ascension Islands. The freighters will supplement the numerous land instrumentation stations of ARDC's Air Force Missile Test Center, which stretch from the Cape Canaveral, Florida, launch site to Ascension Island 5000 miles away.

Upon completion of the modifications, the ships will sail through the Panama Canal and work out of ports on the northeast coast of South America.

THE USE OF NUCLEAR ENERGY for propulsion purposes and its effect on electronic equipment, now under study by the Air Force, received an historic review in Chicago recently during a meeting of Armed Forces specialists.

A key problem, said Colonel William Donics, assistant chief of the communications and electronics division of ARDC, was the effect of radiation on electronic components, in terms of deviation from normal operation, whether that deviation indicated beneficial results or deterioration.

In nuclear-operational tests, the Colonel reported, it has been found that transistors have a very short life. And wire insulation has a reduced resistance in proportion to radiation intensity. Commenting on material breakdown, the air chief said: "Natural rubber deteriorates very rapidly. Insulating materials such as teflon, certain silicone rubbers, polyvinyl chloride, all suffer damage. Polyethylene withstands the radiation in a satisfactory manner, except that when used as a wire insulation, it develops high voltage between the conductor and the shield. Oil-filled capacitors, due to the pressure of the gas which is created from oils, swell and break the seals."

It was also revealed that certain resistors change under radiation, while others, notably wirewound and certain carbon types, appear unaffected. The operation of gas-filled tubes was found to become erratic, and certain types of tube glass envelopes have been found to harden, crack, and break, especially around the base. In a number of instances, glass was found to have a tendency to darken, affecting the transparency of camera and display tubes. An ironic discovery, it was revealed, was that glass used on the cheapest tubes available did not appear affected, other than by discoloration, while the glass on tubes developed especially for reliability under normal conditions hardened and cracked.

A number of different results were obtained with capacitors. Micas, for instance, were found to stand up well; ceramics also stood up. However, the dissipation factor increased on button micas, while the capacity remained fairly stable. Certain paper capacitors survived radiation exposure successfully, except that voltage breakdown was lowered significantly.

Commenting on the future of components in the nuclear age, the Colonel said: "It must be stressed that the advent

of this new environment is not the signal for the whole electronics industry to do an about face and aim every effort at operating under nuclear conditions, to the detriment of other requirements, but rather this is one more environment that must be satisfied by the producers of equipment and components. In this respect, it should be noted that at present there are no facilities available for dynamic testing of components and equipments in a combined temperature and radiation environment. In addition, it is also a stated fact that if the Air Force could use all the space it has available to test equipment from a radiation standpoint only, we would test but an estimated forty per-cent of our planned requirements. Finally, such facilities take about one and a half to two years to build and cost approximately three-quarters of a million dollars."

Noting that the changes which take place due to radiation open up the possibility of taking advantage of these variations, the ARDC expert said that we might capitalize on these revelations by ". . . designing components, circuits and equipment which will operate more effectively or efficiently when exposed to nuclear radiation. . . . Phenomena can possibly be discovered which will alleviate our problems and instead of fighting radiation effects, it may be possible to utilize them to our advantage. Perhaps materials can be discovered which when subjected to radiation will become semi-conductive. This would mean design concepts quite different than those we are used to; for instance, subjecting equipment to a radiation field before it is placed in operation."

AN AIR-TO-GROUND (500-watt) loudspeaker system, designed to deliver a three- to five-minute tape-recorded message to a ground area during a parachute-braked final phase of its descent, has been developed recently.

The system consists of a lightweight magnetic tape playback unit, a 500-watt battery-powered audio amplifier and horn assembly, a pressure-initiated control system, and a three-stage parachute arrangement. The complete affair is housed in a three-section, separable bomb-shaped container measuring 118 inches in length and 18 inches in diameter, and weighing 850 pounds.

The operation of the loudspeaker setup is initiated at the moment the missile is released from the aircraft.

When a portion of the missile reaches an altitude of approximately 4000 feet, the sound reproducer system housed here is placed in operation and descends to earth at the rate of 14 feet a second, broadcasting as it goes.

THE FIRST TRANSLATOR grants were issued as this column was being written. Authorizations were given to the *Mt. Grant Television Booster Service Corporation,* Hawthorne, Nevada, to rebroadcast signals from channel 4 KRON-TV, San Francisco, on channel 70; and to *James R. Oliver,* Bishop, California, operator of KIBS, to rebroadcast transmissions from Los Angeles stations KNXT (operating on channel 2) on channel 70, and from KRCA (channel 4) on channel 73.

The Mt. Grant facility (230 miles from San Francisco) will use 98 watts of effective radiated power from an eight-foot antenna. Oliver (225 miles from Los Angeles) will be permitted to use 83 watts *e.r.p.* from 30-foot antennas, for both the channel 70 and 73 rebroadcasts.

Additional station actions are detailed on page 12.

THE INGENUITY, VISION, and persistence, which the amazing research workers in the electronic world have demonstrated on many occasions, once again was on stage during a 50-year tribute dinner to *RCA's* board chairman.

Described by scientists at the gala event was a noiseless electronic airconditioning system, which comprises large wall panels which become cold under the influence of direct electric current. With a reversal of the electric current, the same panels produce a heating effect. Employing new materials, the system was said to use no motors, fans, pumps, or other moving parts, achieving cooling or heating by both radiation and convection.

What wondrous achievements electronic science brings to our world today for better living tomorrow! L. W.

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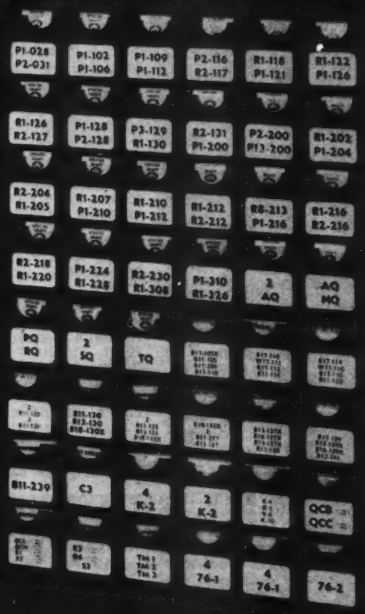

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A "Densitimer"

(*Continued from page* 51)

After this basic calibration is completed, and a "Minimum Readable Time" reading is established, the balance of calibration is simple. Since the circuit is linear, the meter reading and various light conditions will be related. That is, the time at a reading of 50 on the regular meter scale will be twice that at 100, 25 will be four times, etc. A few tests with test strips can be made to check this linearity and, if verified, the meter scale can be calibrated for the minimum time of the two ranges (which would be 100 on the regular meter scale).

In actual calibration, the regular 0-100 scale was used, and notes made of the various meter readings at the various exposure times on each scale. When the plastic scale was made, the distance along the scale length was transferred to the plastic with dividers.

After the unit is calibrated, a chart of the settings of the "Paper Speed" control may be made for different photographic papers. For each type and grade of paper, select an average negative, and make a series of test strips until the exact exposure is known. Then, with the enlarger on the same set-up, place the cell in the shadow area of the negative, and adjust the "Paper Speed" dial until the meter reads the proper exposure. This setting is then the "Paper Speed" for the given type and grade of paper.

Over a period of time, calibration should be re-checked, and the established "Paper Speeds" changed if required, as aging of components will cause a decline in response. —30—

"TICKING IN TV SET"

By WILLARD S. WEISS

TECHNICIANS often get unusual service complaints but this one was a honey. The customer complained of a steady "ticking" noise emanating from his DuMont TV set which had a metal 19AP4 CR tube (the Model RA110).

The ticking, at one second intervals, sounded like something breaking down in the high-voltage cage. The actual trouble turned out to be a paper tag with a "high voltage" warning on it. This tag was tied to the anode lead from the high voltage cage to the CR tube. The tag, which had a dust coating, was suspended about an inch from the side of the cage.

The tag would accumulate a static charge from the high-voltage wire. As the charge built up the tag would be attracted slowly to the grounded metal cage. When it got close enough, the static charge would spark over.

At this point the card would swing back to its normal position and the whole cycle would start over again, about once a second. The spark was audible to the customer as a "tick."

We have discovered that almost anything can happen in service work, so we never discount the possibility of a real "off beat" occurrence like this. —30—

Mac's Service Shop

(*Continued from page 70*)

in last week; and while he was here I was asking him if he thought it was a bad coil or a bad condenser that was making my car hard to start these cold mornings. And he told me!"

"It's always a lot easier to see when the other fellow is offside," Mac remarked; "but just because we ourselves are guilty of a fault does not make it less a fault. I do not think anyone has a quarrel with a true Do-It-Yourselfer, the person who really does depend upon his own knowledge and what he can obtain from common sources, such as books, for repairing his own equipment. It is the guy who wants to pick the brains of other people, either to escape a legitimate service charge or to make himself appear an electronic genius in the eyes of his relatives and friends, that arouses the ire of most of us.

"At the same time," Mac went on slowly, "I am afraid that in some instances steep service charges may have encouraged the TV Do-It-Yourselfers. At least that is the excuse most of them give. They say they can't afford to pay a stiff service charge just to have a bad tube changed, not if they can change it themselves."

"Right in the beginning there were cases of bad overcharges," Barney chimed in, "but very little of that goes on today. Service organizations, self-policing, and ordinary competition has taken care of that. I'm convinced that the dollar a customer pays for TV service these days brings him as much return in knowledge, training, and equipment as he can buy in any other service field."

"I'll buy that!" Mac exclaimed. "The fellow who says that he tries to repair his own receiver because he is afraid of being gouged by a technician also probably tries to be his own doctor, lawyer, mechanic, plumber, and electrician with the same excuse. Of course, there is this much about it: after he has thoroughly fouled up his set, it is going to cost considerably more than the average service charge to restore it to operation again. He will conveniently forget that his messing with something he knows nothing about has brought on these extra charges and will simply quote the total bill as an example of 'what robbers these technicians are!' "

"Well," Barney observed philosophically, "that is about the only consolation I see to the fact that TV sets are becoming more and more complicated, are harder to service, and require more expensive test equipment. A lot of guys will tinker with an alarm clock, but not many will tackle a wristwatch. Color television is a real challenge to technicians who have been in the game since the early days of radio. I can hardly wait to see how the Do-It-Yourselfers are going to manage with it!"

-30-

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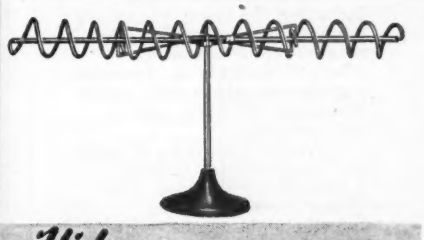

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THE interest in forming service associations and participating in association activities is at a high pitch among electronic service dealers in all sections of the country. Despite the expansion of factory service, the economic condition of the average well managed independent service shop has improved steadily. The over-all condition of the established service industry is much sounder today than that of the parts distributors.

The biggest obstacle in the path of progress for independent service shops is the continuing lack of competent technicians. As promising new talent is trained in the field, service dealers are constantly jarred by the loss of experienced men because of the inducements of higher wages and fringe benefits offered by manufacturers.

The interest of service dealers in forming associations stems from the growing realization that independent service shops must find the ways and means to accomplish two important objectives to insure a healthy business future for themselves. The first of these is to work with other local organizations to eliminate the gyps and the incompetents from the consumer service industry. The other objective is to get adequate charges for service to enable them to pay their technicians wages comparable to those offered by manufacturers.

As business operating problems increase, service dealers have found it necessary to make an assessment of their associations' basic philosophies. Is the primary purpose of present service associations technical or business?

In radio service days, the majority of service associations were fundamentally concerned with the technical aspects of servicing radio and sound equipment. There was only a minor interest in business management since it was assumed that a competent technician could get all of the business he could handle.

When television made electronics servicing a two billion dollar industry, it changed the entire complexion of the consumer service business. The need for improved business promotion methods, better customer relations, dealing with unethical competition, and training for technical employees overshadowed the importance of individual technical competence on the part of the service shop owner.

The result is that present service associations are primarily concerned with the management problems inherent in operating a service business in a highly competitive market.

Since there is no single pattern in business types that would apply in every section of the country, there is a wide difference in the types of service associations that have been formed. In some areas where a number of large, successful TV-appliance retailers dominate the market, there is a preponderance of shops that specialize in service and do not handle the sale of TV or radio sets. In those areas, as a general rule, there is no cooperation between the retailers and the service associations.

In other areas, a high percentage of the service shops sell TV and radio sets to provide supplementary income. While service is their major business, they do understand the dealers' sales problems. Where this situation exists, there usually is very good cooperation between the dealers and the local service association.

Because of the basic differences in the structure of individual associations, service groups operating in separated areas may not see eye to eye on what must be done to bring about some measure of stability in the electronic service industry. Where dealers and service operators remain aloof from each other's problems they both lose the benefits they would gain by working together on programs for their common good.

In the course of the osmotic process that leads successful service dealers to shift their emphasis from the technical to the business side of their operations, the professional electronic service technician has been sorely neglected. There are thousands of men who have made electronic servicing their profession. They do not aspire to operate their own shops but are ambitious to be top-flight professionals in their chosen field.

Early this year an organization of service technicians was formed in Portland, Oregon. Known as the Northwest Electronic Technicians Association, its goal is to build respect for and competence in professional technicians engaged in electronics service work. Their motto, *Electra Eta,* means electronic efficiency.

In Minnesota, the Minnesota Television Service Engineers Association has set up standards and nomenclature for electronic service technicians.

In Detroit, the Television Service Association of Michigan recently sponsored the formation of the Television Technicians Guild of Detroit. This is an organization of professional service technicians with complete management and control in the hands of its technician-members.

In a recent article Harold Heipel, president of TTG, outlined the philosophy behind this new technical association:

"A square yard is all you need. Or is it? True, a square yard of space is enough in which to earn a living, if it contains a set to be repaired, a technician who knows how, and his equipment.

"We have always thought that the most important ingredient in that square yard, and the most difficult to get, was the know-how. Most of us have worked and studied a long time to achieve it, because we assumed that once we had the skill and the ability we would automatically be an above-average individual whose square yard of space would be best equipped to earn a livelihood.

"Now we are picking ourselves up off the floor and saying in a dazed voice, 'What happened?'

"What happened is this—while we were so busy preparing our own ingredients for our square yard we forgot a couple of *small details*. The first is that the most important item in our space is the set to be repaired. If there is no set there the technician may as well eat the pride he has in his profession, because that is all he will have left. The second *little thing* we have missed is the fact that the world is bigger than a square yard, and it is the things that happen outside our square yard that determine whether there will be a set in it.

"We have been living in a dream world, each in his own square yard, surrounded by a velvet curtain of indifference to keep the ugly world from interfering with the sublime rebirth of the set in our hands. This dream world of ours is now shaking with the rumble of the *big business* steam roller and we are in for a rude awakening. There will be no set in our square yard tomorrow—unless we do something about it *right now!*

"It is up to you! Two things you must do if you want to survive. You must get yourself out of your square yard and into the world. You must get yourself a voice that will be heard.

"The things in the world that affect your livelihood are being brought to light by groups of individuals just like you who have joined together to protect their common interests. Service dealers have found in TSA a powerful force for mutual aid. The Television Technicians Guild (TTG) is bringing to service technicians the events of the world which can make or break them. Association with your local group, be it TSA, TTG, or any other, is your only hope of survival. Join! Have a voice in the group. Let your voice be heard. Unite to fight! Or retire to your square yard, draw your velvet curtain, and wait voiceless for the set which will not come."

Your suggestions about how this magazine can be of assistance will be welcomed. Address them to: Service Editor, RADIO & TELEVISION NEWS, 366 Madison Ave., New York 17, N. Y.–30–

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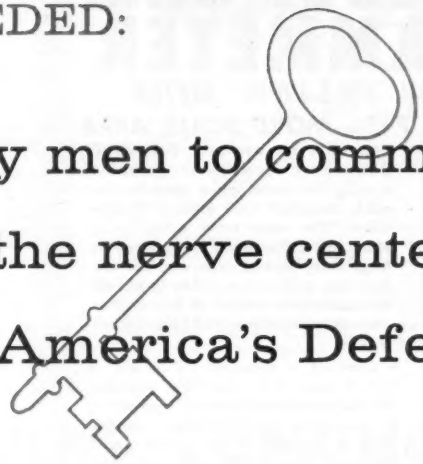

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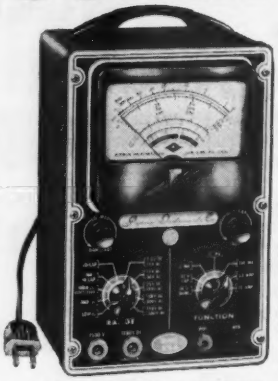

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D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts. **A.C. VOLTS:** 0 to 15/30/150/300/1,500/3,000 Volts. **OUTPUT VOLTS:** 0 to 15/30/150/300/1,500/3,000 V. **D.C. CURRENT:** 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes. **RESISTANCE:** 0 to 1,000/100,000 Ohms 0 to 10 Megohms. **CAPACITY:** .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad Scale for checking quality of electrolytic condensers). **REACTANCE:** 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms. **INDUCTANCE:** .15 to 7 Henries 7 to 7,000 Henries. **DECIBELS:** —6 to +18, +14 to +38, +34 to +58.

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Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

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20,000 OHMS PER VOLT ALLMETER

Includes services never before provided by an instrument of this type.

Read and compare features and specifications below!

FEATURES

- **A sensitive, accurate Volt-Ohm-Milliammeter with *giant* meter and *mirrored* scale.**
- **An accurate direct-reading Capacity meter.**
- **A Kilovoltmeter.**
- **An R.F. Signal Tracer.**
- **An Audio Signal Tracer.**
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SPECIFICATIONS

8 D.C. VOLTAGE RANGES: (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30,000 Volts.

7 A.C. VOLTAGE RANGES: (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.

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2 CAPACITY RANGES: .00025 Mfd. to 30 Mfd.

5 D.C. CURRENT RANGES: : 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

3 DECIBEL RANGES: — 6 db to + 58 db.

R. F. SIGNAL TRACER SERVICE:

Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.

AUDIO SIGNAL TRACER SERVICE:

Functions in the same manner as the R.F. Signal Tracing service specified above except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe, Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. Only

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MOSS ELECTRONIC DIST. CO., INC. 3849 Tenth Ave., New York 34, N.Y.

Superior's New Model TV-11

TUBE TESTER

SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system*, the user can instantly identify which element is under test: Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE — The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover

$47.50 NET

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

TESTING TUBES

★ **Employs improved TRANS-CONDUCTANCE circuit.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

★ **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.

★ **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

★ **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in handsome rugged portable cabinet sells for only

$72.50 NET

ALSO TESTS TRANSISTORS!

Superior's New Model TV-40

PICTURE TUBE TESTER

NOT A GADGET—NOT A MAKE-SHIFT ADAPTER, BUT A WIRED PICTURE TUBE TESTER WITH A METER FOR MEASURING DEGREE OF EMISSION—AT ONLY $15.85

Of course you can buy an adapter for about $5—which theoretically will convert your standard tube tester into a picture-tube tester; or a neon type instrument which sells for a little more and is supposed to be "as good as" a metered instrument. Superior does not make nor do they recommend use of C.R.T. adapters or neon gadgets because a Cathode Ray Tube is a very complex device, and to properly test it, you need an instrument designed exclusively to test C.R. Tubes and nothing else.

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton ! !

- Tests *all* magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only

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For the first time ever: ONE TESTER PROVIDES ALL THE SERVICES LISTED BELOW!

Superior's New Model 76

IT'S A
CONDENSER BRIDGE
with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A
RESISTANCE BRIDGE
with a range of 100 ohms to 5 megohms

IT'S A
SIGNAL TRACER
which will enable you to trace the signal from antenna to speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A
TV ANTENNA TESTER
The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

Specifications

✓CAPACITY BRIDGE SECTION
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the power factor of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

✓RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

As Design Engineers, we the undersigned would like to say that the Model 76 is in our opinion the best combination unit of its kind we have been privileged to design. Although it is comparatively a low-priced tester, it will, after you become acquainted with its multiple services, be your most frequently used instrument.

S. LITT
L. MELENKEVITZ

✓SIGNAL TRACER SECTION
A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

✓TV ANTENNA TESTER SECTION
Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy. Only

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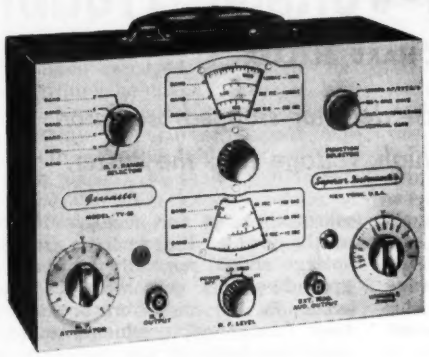
MOSS ELECTRONIC DIST. CO., INC., 3849 Tenth Ave., New York 34, N. Y.

Superior's New Model TV-50

GENOMETER



A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

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7 Signal Generators in One!

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- ✔ R.F. Signal Generator for F.M.
- ✔ Audio Frequency Generator
- ✔ Bar Generator
- ✔ Cross Hatch Generator
- ✔ Color Dot Pattern Generator
- ✔ Marker Generator

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

DOT PATTERN GENERATOR (FOR COLOR TV): Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

BAR GENERATOR: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

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50¢	7225	7240	7250	7273
	7340	7350	7373	7375
EA.	8000	8006	8025	8040
	8106	8125	8140	8150
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POST-	6300	6400	6500	6575
PAID	6775	6800	6850	6900
	7040	7050	7075	7100
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	7275	7300	7306	7325
	7400	7406	7500	7606
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	8425	8450	8475	8500
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An Unusual A.F.C.—High-Voltage Trouble

By **RICHARD BLITZER**

A defect in the phase detector stopped oscillator action, eliminating high voltage and the raster.

A DEFECT in the horizontal automatic frequency control (a.f.c.) circuit normally changes the frequency of the horizontal oscillator, causing picture tear-out. Lack of raster, due to missing high voltage, is seldom attributed to the a.f.c. circuit.

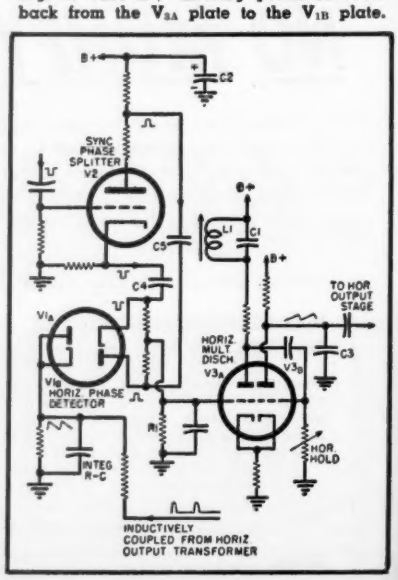
This article describes precisely such a trouble that the writer encountered. The receiver is a *Tele-King* chassis TVJ, employing the a.f.c. circuit shown in Fig. 1. Since an understanding of the circuit theory is required, we will briefly review the operation. V_{3A} and V_{3B} are a cathode-coupled multivibrator. C_3, in the plate of V_{3B}, is the charge-discharge capacitor which produces the desired saw-tooth waveshape. The oscillator's frequency is made more stable by the sine-wave tank circuit, L_1-C_1, in the plate circuit of V_{3A}.

V_{1A} and V_{1B} form the horizontal phase detector circuit which, by controlling the bias at the grid of V_{3A}, determines the multivibrator's frequency. The diodes are made to conduct by sync pulses from V_2, the sync phase splitter. Proper frequency and phase relationship between these sync pulses and the rectangular deflection waveshape from the output transformer, changed into a saw-tooth by the integrating RC circuit, cause V_{1A} and V_{1B} to conduct equally. Plate current of V_{1A} flows up through R_1, making the V_{3A} multivibrator grid positive. Plate current of V_{1B} flows down through R_1, making the V_{3A} grid negative. These equal and opposing voltages cancel and the grid voltage is zero. Frequency drifting of the horizontal multivibrator changes the phase relationship between sync pulses and deflection waveshape so that either V_{1A} or V_{1B} conducts more heavily. Either a positive or a negative voltage is then developed at the V_{3A} grid, pulling the oscillator back to its correct frequency.

The trouble that prompted this article was lack of high voltage. When the receiver was set up on the test bench, an oscilloscope showed a sine-wave signal of about 15,000 cycles per second at the multivibrator plates of V_{3A} and V_{3B}. This, of course, was undesirable. The frequency of 15,000 cycles per second was approximate. It was concluded that the frequency was 15,000 cps by the number of cycles seen for the particular setting of the scope's sweep controls. Shorting across L_1 and C_1 stopped the 15,000 cycle sine waves. A d.c. voltmeter check showed about normal voltages on the multivibrator except for negative 10 volts at the grid of V_{3A}, whereas this grid voltage should normally be zero. By grounding this grid with a jumper across R_1, the multivibrator-discharge tube functioned, producing a 15,000 cycle saw-tooth at the V_{3B} plate, and the high voltage and raster came back. However, the raster had a wide black vertical bar on it. This seemed to indicate a 15,000 cycle per second sine wave reaching the video input to the picture tube. Opening the grounded jumper from the grid of V_{3A} removed the raster.

The negative 10 volts at the grid of V_{3A} could be due to the heavy conduction of the lower phase detector V_{1B}. Since the filament of this tube is in series with the heater of the sync phase splitter V_2 and with others (not shown in Fig. 1), V_1 could not be removed without affecting the others. Connecting the oscilloscope to the cathode of V_{1A} showed a negative-going sync pulse of correct amplitude, about 13 volts peak-to-peak. This was measured on the scope which had been calibrated for a 6.3 volt wave from the scope's test jack. At the plate of V_{1B} a large sine wave was noticed superimposed on the positive going sync pulse. This apparently drove V_{1B} into heavy conduction producing the negative voltage across R_1 and keeping the multivibrator V_{3A} from operating.

Fig. 1. Poor B+ filtering permitted feedback from the V_{3A} plate to the V_{1B} plate.



Opening the coupling capacitor C_4 did not improve operation, but disconnecting C_5 from V_{1B} produced operation of the multivibrator with resulting high voltage and raster. The raster still had the 15,000 cycle-per-second black vertical bar down the center. Restoring C_4 and C_5 to their proper connections again removed the raster. Removing the sync phase splitter, V_2, had no effect on bringing the raster back. (A dummy tube having a good filament but all other pins cut off was used in place of V_2 since its filament, as noted, was in series with others. A bad tube, which had been saved for just such a job, was used for this purpose.)

With V_2 removed, the oscilloscope still showed the 15,000 cycle sine wave going through C_5 to the plate of diode V_{1B}. Further, the scope showed this signal at the "B+" point. Here then lay the trouble since an adequately bypassed "B+" could not have a 15,000 cycle-per-second signal developed there. Checking with an ohmmeter showed that filter capacitor C_2, 120 μfd., was faulty. Replacing it produced the raster without the vertical black bar.

This trouble, then, consisted of a leaky low voltage "B+" filter capacitor, C_2, which allowed a 15,000 cycle sine wave from the horizontal multivibrator stability circuit, L_1-C_1, to feed through to the phase detector a.f.c. diode V_{1B}. Heavy conduction of V_{1B} biased the grid of V_{3A}, preventing its proper operation as a multivibrator.

While the defective component that was the ultimate cause of trouble in this instance was in the power supply, similar effects can be produced by breakdowns that are more immediately related to the a.f.c.-oscillator circuits.

In another model using a very similar a.f.c. circuit, a failure of a capacitor in this part of the receiver also resulted in no high voltage. The circuit is exactly as shown in Fig. 1 except that the rectangular deflection wave, which is applied to the plate of V_{1A} and the cathode of V_{1B} through the integrating RC network, is coupled through a .05 μfd. capacitor instead of being inductively coupled. This capacitor couples the deflection waveshape from the horizontal output transformer for phase comparison with the sync pulses, but keeps the "B+" voltage from reaching V_{1A} and V_{1B}.

When a receiver using this circuit was on the bench, it was found that the .05 μfd. capacitor was leaky. Plate voltage of V_{1A} was found to be +150 volts; normal measurement should have been zero. This positive voltage caused V_{1A} to conduct heavily. Plate current, flowing upward through R_1, placed a positive voltage at the multivibrator grid V_{3A}. This was just the reverse condition described previously when the grid was negative. With a positive grid, V_{3A} conducted constantly, preventing multivibrator operation and stopping high voltage. –30–

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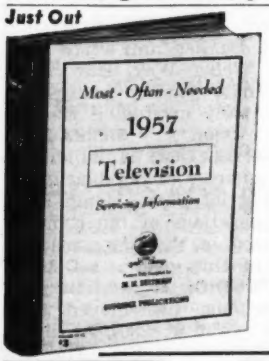

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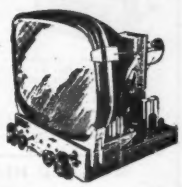

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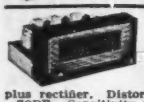

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Within the Industry

(*Continued from page 28*)

of the Armed Forces Education Division.

He is a member of several business, professional, and fraternal organizations and the author of five textbooks. He makes his home in Alexandria, Va.

* * *

DAYSTROM, INC. has announced the formation of a systems division which will design, build, test, and install complete systems for automation applications. Chalmer E. Jones, formerly assistant to the president of *Heath Company,* another *Daystrom* subsidiary, will head the new operation in LaJolla, Cal. . . . **ALLEGHENY LUDLUM STEEL CORPORATION** has purchased **PAUL R. REPATH, INC.,** Los Angeles producer of electrical steel laminations, metal stampings, and deep-drawn transformer cans . . . **WATERS MANUFACTURING, INC.** of Wayland, Mass. has established a new electronic components division which will be headed by Walter T. Hynes . . . **SPRAGUE ELECTRIC COMPANY** has acquired a controlling interest in **CREAS,** Milan, Italy capacitor manufacturer. The move is intended as an aid to re-establishing the overseas market for capacitors in dollar-short areas . . . **NUCLEAR INSTRUMENT AND CHEMICAL CORPORATION** has changed its corporate name to **NUCLEAR-CHICAGO CORPORATION** to capitalize on the firm's well-known tradename . . . **MICROWAVE ASSOCIATES** and **TECHNICAL OPERATIONS, INC.** have formed a new, jointly owned company, **POWER SOURCES, INC.** The new corporation will produce semiconductor power supplies . . . **COMPUTER-MEASUREMENTS CORP.** of North Hollywood, Cal. has been merged with **HANCOCK MANUFACTURING CO.** of Jackson, Mich. The merged firm will retain its identity and present management . . . **MAGNECORD, INC.** has acquired **A-V MANUFACTURING COMPANY** . . . **R. S. LOHMANN CO.** has been established at 13331 Livernois, Detroit 38, Mich. to service jobber and industrial accounts in Michigan.

* * *

ALLEN B. DU MONT LABORATORIES, INC. and *Chromatic Television Laboratories, Inc.* have reached an agreement whereby *Du Mont* will undertake a program designed at getting the *Chromatic* single-gun color tube and the color TV set using this tube into production.

It is estimated that preparatory work leading to mass production of the tube and color receivers will be completed within a year. When production begins, the *Chromatic* tube will be available to all set manufacturers as well as for *Du Mont* receivers.

* * *

O. B. HANSON, vice-president of engineering services for *Radio Corporation of America,* was named winner of the 1956 John H. Potts Memorial Award, bestowed annually by the Audio Engineering Society.

The citation was made in "recognition of his contributions to better broadcasting systems and facilities." Mr. Hanson was formerly vice-president and chief engineer for *NBC* and a pioneer of nearly thirty-five years in radio and television.

* * *

HENRY F. DeLONG has been appointed general manager of *General Electric Company's* multi-million dollar Cathode-Ray Tube Department.

He has served as manager of manufacturing for the company's incandescent lamp facility in Ohio since 1952. In his new position, Mr. DeLong will direct operations of the department from headquarters at Electronics Park in Syracuse, N. Y.

Mr. DeLong has been associated with the company for 20 years. He is a native of Spokane, Wash., and received his B.S. degree in Chemical Engineering from Purdue University.

The company's cathode-ray tube manufacturing facility consists of large plants in both Syracuse and in Buffalo, N. Y.

* * *

JOHN F. RIDER PUBLISHER, INC. has moved to new and larger quarters at 116 West 14th Street in New York City . . . **ERIE RESISTOR CORPORATION** of Erie, Pa. has built a new plant at 13010 S. Weber Way, Hawthorne, Calif. The new facility houses the company's rapidly expanding Electro-Mechanical Division . . . **SIERRA ELECTRONIC CORPORATION** is building a new 35,000 square foot building in Bohannon Industrial Park, Menlo Park, Calif. All operations of the company will be located in the new structure by the end of this year . . . **CIRCUIT INSTRUMENTS INC.,** a subsidiary of **IRC,** Philadelphia, has moved to a modern new plant at 2801 Anvil St., North, St. Petersburg, Fla. The new location provides 12,500 square feet of floor space . . . A three-acre tract has been acquired at Saticoy and Ethel Streets, North Hollywood, Calif. by **U.S. ELECTRONICS DEVELOPMENT CORPORATION** and will be used as the site for three new 20,000 square foot buildings the company will construct early next year . . . **COOK ELECTRIC COMPANY** is opening a Technological Center on a 15-acre tract in Morton Grove, Illinois. The seven single-story buildings comprising the "center" will provide a total floor area of 158,000 square feet and employ 1000 persons. A heliport and paved parking facilities for 1200 cars are included . . . **ALTEC LANSING CORPORATION** has broken ground for its third Southern California factory. The new plant at Anaheim will raise to 200,000 square feet the facilities of the audio firm . . . **MINNEAPOLIS-HONEYWELL REGULATOR COMPANY** has purchased the three-story,

250,000 square foot Hathaway plant in Boston to house its Transistor Division. The division is currently located in Minneapolis . . . **SYLVANIA ELECTRIC PRODUCTS INC.** has formally opened its new electronics plant in Hillsboro, N. H. . . . **NATIONAL ELECTRONICS CORPORATION** of Los Angeles has moved its corporate headquarters to its new plant at 11815 Vose St., North Hollywood, Cal. The company will continue to operate its other two plants in Los Angeles and North Hollywood . . . **PLASTIC CAPACITORS, INC.** has moved to new and larger quarters at 2620 N. Clybourn Ave., Chicago, Ill. . . . **OLSON RADIO WAREHOUSE** has purchased the inventory, furniture, and fixtures of **PAT MALONE, INC.** at 123 N. Western Ave. in Chicago and will operate the facility as its seventh outlet. The original Chicago store on Randolph St. will be continued . . . **RADIO ELECTRIC SERVICE COMPANY** recently opened a 10,000 square foot showroom and warehouse in Allentown, Pa. Located at 1313 Linden St., the new store will handle a complete stock of electronic parts and equipment in addition to high-fidelity and commercial sound gear . . . **DAVID BOGEN CO., INC.** has opened a new manufacturing plant in Paramus, N. J. . . . **STROMBERG-CARLSON** has purchased the "Style Manor" factory at 1400 N. Goodman St., Rochester from **BOND STORES, INC.** The plant will be used as an electronic research, engineering, and manufacturing center . . . **GENERAL ELECTRIC COMPANY** has established a new district sales offices for tubes and other electronic components at the Brown-Marx Building in Birmingham, Ala. -30-

TELEVISION IN ISRAEL

TELEVISION makes its debut in this republic of 1,600,000 in a vast mid-December exhibition sponsored by the Israel Radio and Electronics Association but the advent of normal video service in the Land of the Bible is still in the early planning stages.

The event is to feature a closed-circuit TV demonstration as a result of an agreement with DuMont to supply the Israeli exhibitors with the necessary apparatus. Cameras will be mounted at the exhibition's entrance, thereby allowing those inside to look at the passing throngs. The set-up marks the first time TV equipment of any nature has been publicly demonstrated in Israel. -30-

RECORDER SERVICE HINT

By JAMES A. McROBERTS

FAILURE of the bias oscillator in the Pentron 9T3 tape recorder may result from a defective .003 μfd. capacitor, C_{19}, in the grid circuit of the recorder's erase oscillator.

The failure to erase followed by a check of the bias generated across this capacitor, which is shunted by the grid leak resistor R_{18}, will indicate failure of the erase or bias oscillator.

Following a quick test of the voltage and tube substitutions, if available (erase oscillator-power output tube is a 6V6), replace the grid capacitor C_{19} to correct this fault. -30-

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1AX2	.79	6A7	.57	6C8	.47	6SK7	.50	7C6	.43	12K8	.49
1B3GT	.68	6AB4	.45	6CB6	.51	6SL7GT	.57	7C7	.45	12SA7	.48
1S4P	.38	6AB8	.80	6CL6	.71	6SN7GT	.57	7E5	.23	12SA7GT	.48
1C5GT	.41	6AC5GT	.59	6CD6G	1.18	6SQ7	.41	7E6	.30	12SG7	.55
1D5GP	.43	6AC7	.67	6CS6	.51	6SR7	.42	7E7	.49	12SH7	.47
1E7GT	.41	6AF4	.79	6DC6	.48	6SS7	.41	7F7	.59	12SJ7GT	.45
1G6GT	.41	6AG5	.50	6F7G	.43	6T7G	.43	7F8	.70	12SK7	.48
1H5GT	.47	6AG7	.89	6T8	.68	7Q7	.75	12SK7GT	.50
1LA4	.57	6AH4	.80					7H7	.50	12SL7GT	.60
1LA6	.47	6AH6	.70					7J7	.75	12SN7GT	.57
1LB4	.59	6AK5	.54					7K7	.75	12SQ7GT	.40
1LC5	.49	6AL5	.42					7L7	.58	14A7	.45
1LN5	.47	6AL7GT	.70					7N7	.50	19BG6G	1.15
1N5GT	.50	6AQ5	.46					7Q7	.59	19T8	.70
1R4	.66	6AQ6	.42					7Y4	.35	25BQ6GT	.85
1R5	.51	6AQ7GT	.70					7Z4	.40	25L6GT	.47
1S4	.59	6AN8	.80					117Z3	.37	25Z6GT	.37
1S5	.51	6AN8	.80					117ZGGT	.52	35A5	.46
1T4	.51	6AS5	.48					12AT6	.41	35B5	.48
1T5GT	.48	6AT6	.39					12AT7	.66	35C5	.48
1U4	.47	6AU4	.65					12AU6	.43	35L6GT	.47
1U5	.50	6AU5GT	.60					12AU7	.59	35W4	.39
1U6	.53	6AU6	.43					12AV6	.42	35Y4	.40
1X2A	.88	6AV6	.39					12AV7	.67	3523	.41
2A3	.80	6AX4	.57					12AX7	.63	3525GT	.38
3A4	.51	6AX5GT	.57					12AY7	.90	4S7SGT	.40
3AL5	.57	6BA6	.47					12CA6	.46	50A5	.48
3AU6	.57	6BA7	.49					12BA7	.60	50B5	.48
3AV6	.57	6BC5	.50					12B4	.68	50C5	.48
3BA6	.60	6BD5GT	.53					12BE6	.46	50L6GT	.48
3BE6	.60	6BE6	.46					12BH7	.60	70L6GT	.45
3Q5GT	.57	6BF5	.40							70L7GT	.50
3S4	.57	6BQ6G	1.18								
3V4	.58	6BH6	.51								
5AQ5	.60	6BK5	.68								
5AT8	.80	6BK7A	.76								
5Y3	.60	6BL7GT	.75								
5Y4	.69	6BN6	.58								
5U4	.80	6BQ5GT	.80								
5U4G	.49	6BQ7A	.58								
5V4G	.58	6BZ7	.58								
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6K6GT	.39	6Y6G	.60								
6K7	.39	7A4-XXL	.47								
6K7GT	.39	7A5	.53								
6K8G	.65	7A8	.45								
6K8GT	.65	7A7	.45								
6L6G	.68	7A8	.45								
6S4	.49	7B4	.44								
6SA7	.48	7B5	.41								
6SC7	.48	7B6	.42								
6SD7GT	.87	7B7	.43								
6SH7	.44	7B8	.47								

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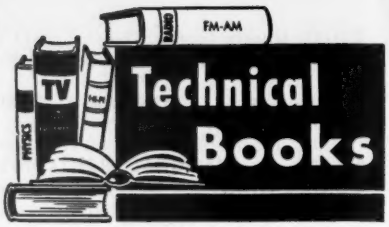

"VACUUM-TUBE CIRCUITS AND TRANSISTORS" by L. B. Arguimbau. Published by *John Wiley & Sons, Inc.*, New York. 637 pages. Price $10.25.

This is a fundamental treatise on transistors, FM, inverse feedback, noise, AM, and other pertinent circuitry written for engineers, students, and others interested in the application of vacuum tubes and transistors to electronic equipment of various types.

The subject matter is treated from the mathematical viewpoint and the reader is advised to have his sliderule handy or college math courses well in mind before tackling this text. As a reference work and a basic handbook this volume admirably fills the bill.

* * *

"PULSE AND DIGITAL CIRCUITS" by Jacob Millman & Herbert Taub. Published by *McGraw-Hill Book Co., Inc.*, New York. 687 pages. Price $12.50.

This text for senior and graduate courses provides a description and an analysis of the circuits and techniques common to many of the newer fields of electrical engineering. Such subjects as wave shaping, pulse amplifiers, multivibrators and time-base generators, blocking oscillators and counting circuits, transmission gates and voltage comparators, and digital computer circuits are included.

* * *

"MATHEMATICS FOR ELECTRONICS" by H. M. Nodelman & F. W. Smith. Published by *McGraw-Hill Book Company, Inc.*, New York. 376 pages. Price $7.00.

This book has been especially written for the TV engineering student and the practicing engineer. It is designed to provide a correlation between engineering practice and those mathematical topics which are pertinent to the electronics and communications fields.

Since the emphasis is on the practical applications of mathematics, this text is a real boon to electronics men. The introductory chapter outlines the uses of mathematics in electronics and gives copious examples of the function of math in practical day-to-day operations.

The balance of the text deals with specific applications. Five appendices cover common and natural logarithms, trigonometric functions, integrals, etc.

* * *

"TV MANUFACTURERS' RECEIVER TROUBLE CURES" by Rider Staff. Published by *John F. Rider Publisher, Inc.*, New York. 105 pages. Price $1.80. Paper bound. Vol. 8.

In this eighth volume in the current

series, the television receivers made by *RCA, Sentinel, Sparton, Stewart-Warner, Stromberg-Carlson, Sylvania, Westinghouse,* and *Zenith* are covered.

As with the earlier books, specific cures are cited as prepared by the service departments of the manufacturers concerned. A cumulative index covering the entire series is also included.

* * *

"HANDBOOK OF TUBES AND SEMICONDUCTORS" compiled by Tech-Rep Division of Philco. Published by *Philco Corporation*, Philadelphia. 207 pages. Price $2.00. Paper with spiral binding.

This practical manual consists of six sections and covers servicing and maintenance aids, tube basing diagrams, a listing of conventional tubes and their ruggedized equivalents, tube characteristics charts, and specifications on semiconductor devices.

The inclusion of data on both semiconductors and tubes in a single manual is a boon to technicians and those who have occasion to consult such information sources regularly in the course of their work.

* * *

"BASIC ELECTRICITY" by Paul B. Zbar & Sid Schildkraut. Published by *McGraw-Hill Book Company, Inc.*, New York, for the RETMA. 84 pages. Price $1.75. Paper bound.

This is a laboratory manual for radio-television technicians as prepared by the teaching staff of the Radio-Electronics-Television Manufacturers Association. The book is divided into 27 "jobs" or laboratory experiments. Each of the experiment sheets lists the objective of the lesson, materials involved, and then the procedures the student is to follow. Each lesson carries its own test questions on the material covered.

This volume is one of a series being put out by RETMA in an effort to upgrade the profession and standardize training practices.

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"HOW TO BECOME A RADIO AMATEUR" by ARRL Staff. Published by the *American Radio Relay League*, West Hartford, Conn. 109 pages plus catalogue section. Price 50 cents. Paper bound.

This fifteenth edition of one of the ARRL's most popular manuals has been completely rewritten and revised to make it even easier for the beginner to get started on his license.

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"ELECTRONICS DATA HANDBOOK" edited by Nelson M. Cooke. Published by *Allied Radio Corporation*, Chicago. 64 pages. Price 35 cents. Paper bound.

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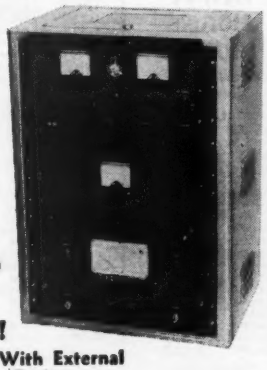

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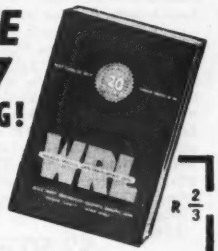

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"TELEVISION SERVICING COURSE" compiled by M. N. Beitman. Published by *Supreme Publications*, Highland Park, Ill. 192 pages. Price $3.00. Paper bound.

This book has been prepared as a home-study text for the radio service man who wants to get into television. The emphasis in this book is on the practical aspects of servicing with all extraneous material ruthlessly eliminated. The text is divided into fourteen lessons with the student beginning his studies with an analysis of circuit faults by means of the CRT patterns.

Although the text moves along rapidly, the presentation is clear and easy to grasp. The lavish use of photographs, schematics, and line drawings helps convey the subject content to the student.

* * *

"BASICS OF PHOTOTUBES AND PHOTOCELLS" by David Mark. Published by *John F. Rider Publisher, Inc.*, New York. 125 pages. Price $2.90. Paper bound.

Since these components are enjoying wide popularity in all types of electronic equipment, the subject matter is of interest to a wide segment of the industry.

This book covers the photoelectric effect, photoconductive cells, photovoltaic cells and phototubes, photocurrent amplifiers, instrument and commercial applications. A bibliography is also appended. Photographs and schematics are an added fillip to the text material.

* * *

"HOW TO MAKE GOOD TAPE RECORDINGS" by C. J. LeBel. Published by *Audio Devices, Inc.*, 444 Madison Ave., New York 22, N.Y. 146 pages. Price $1.50 paperbound. $2.50 cloth.

A companion volume to the author's handbook on disc recording, this new work should find an even greater audience because of the more widespread popularity of the tape medium.

Written in simple and non-technical language, this is truly a "how-to" volume. The text covers the operation of a tape recorder, the various characteristics of such instruments, how to select a machine and tapes, making a microphone recording, tape editing, stereo recording, putting together a recording show, acoustics of the recording room, and a glossary of tape recording terms.

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by guest experts, who are specialists in those particular fields.

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"TRANSISTOR CIRCUIT HANDBOOK" by Louis E. Garner, Jr. Published by *Coyne Electrical School* and distributed by *Howard W. Sams & Co., Inc.*, Indianapolis. 410 pages. Price $4.95.

If the requests received by this magazine are any criteria, there has long been a need for a textbook on transistor circuitry, written for the experimenter, hobbyist, and the "do-it-yourselfer."

Mr. Garner's writings are well known to the readers of this magazine. They are familiar with his lucid and easy-to-understand exposition and have enjoyed building his unique and practical transistor circuits.

This book will be welcomed with open arms since there is something for everyone in this volume. Amplifiers, oscillators, special purpose circuits, audio equipment applications, r.f. uses, transistors in test instruments, control circuits, and gadgets.

Transistor characteristics and a discussion of special construction techniques complete the book.

* * *

"TV REPAIR QUESTIONS AND ANSWERS" by Sidney Platt. Published by *John F. Rider Publisher, Inc.*, New York. 106 pages. Price $2.10. Paper bound. (Vol. 5 Sound & L-V Circuits.)

This is the last of the handbooks in this series in which the technique of troubleshooting a television receiver has been reduced to "questions and answers."

Like the earlier parts of this series the material is written for the practicing technician so all extraneous theory and non-essential data has been reduced to a minimum. This volume covers the servicing of the sound sections and low-voltage sections of the TV receiver, thus rounding out the entire circuitry.

Those who have purchased and used the earlier volumes in this series will need no further inducement to invest in this final work.

* * *

"MANDL'S TELEVISION SERVICING" by Matthew Mandl. Published by *The Macmillan Company*, New York. 456 pages. Price $6.50. Revised edition.

Service technicians who found the earlier edition of this book helpful will welcome this up-to-date revision. The most useful features of the original text have been retained and, in addition, new and pertinent data supplied.

New material included in this edition covers fundamentals of monochrome and color TV, servicing of u.h.f. and v.h.f., operation of cascode tuners and automatically focused tubes, new circuits and tuners. The section on 600 ma. series filament strings has been enlarged, as has the "Master Index to Common Television Troubles." -30-

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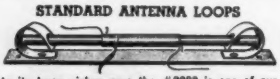

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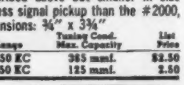

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Dimensions: ¼" x ¾" x 3¾"

Cat. No.	Q @ 790 KC	Freq. Range	Tuning Cond. Max. Capacity	List Price
2004	500	540-1650 KC	365 mmf.	$2.50
2005	450	540-1650 KC	125 mmf.	2.50

UNSHIELDED MINIATURE OSC.

These coils are designed for use in a converter circuit using only one transistor for both the oscillator and mixer. Dimensions: ⅜" x 1" high

Cat. No.	Tuning Cond. Max. Capacity	I.F. Freq.	Use	List Price
2020	365 mmf.	455 KC	Osc.	$2.00
2022	70-100 mmf.	455 KC	Osc.	2.00

VARIABLE CONDENSERS

Catalog #2110 is a miniature 2-gang variable condenser. The antenna section has a range of 10-130 mmf. Catalog #2112 is a standard size 2-gang condenser having a range of 10-365 mmf. for both sections. Shaft is ¼" dia. x 1⅛" long.

Cat. No.	Sections	Dimensions	List Price
2110	2	⅞" x 1⅜" x 1⅜"	$2.50
2112	2	2⅜" x 1⅞" x 1⅜"	3.50

SHIELDED SUB-MINIATURE OSC.

The 2021 oscillator coil is a sub-miniature shielded version of the #2022 described above. Identical in size to our 9-C1 and 9-C2 I.F. transformers. Designed for use with a condenser having a maximum capacity of approximately 100 mmf. (Miller #2110). ⅜" sq. x ⅝" high

Manufactured under K-TRAN patents of and by Automatic Manufacturing Corp.

Cat. No.	Tuning Cond. Max. Capacity	I.F. Freq.	Use	List Price
2021	100	455 KC	Osc.	$2.50

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Wide sweep with crystal markers for aligning TV IF amplifiers. 20 MC-50 MC. $325.00 value.
Special price.....ea. **$80.00**

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Wide sweep, switchable, with crystal markers for aligning TV tuners, receivers. All 12 VHF channels. $795.00 value.
Special price.....ea. **$195.00**

KAY MODEL MEGA-PIX
Output signal frequencies; TV RF picture and sound frequencies. Maximum picture and sound carrier output: 250 MV across 72 ohms. All 12 VHF channels. $495.00 value.
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KAY MODEL MEGA-SWEEP, CALIBRATED
Displays band-pass, single dial tuning from 50 KC to 950 MC. Dial indication of approximate output freq. $495.00 value.
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Above Equipment Used, in good condition

RCA VOLTOHMIST MODEL 195A
Used, good condition. $65.00 value.
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TV CHASSIS
Mfg. by American Television, choice of 21", 24", 27". Completely wired, less tubes. Buy them for replacement parts: flyback worth $15.00, power, transf. worth $15.00 Std. Coil cascode tuner worth $20.00, condensers, resistors, controls, etc.
Special price.....ea. **$19.95**

TV CHASSIS
Same as above except seleniums instead of power transformer and snap type tuner other than Std. Coil. Uses latest type series string tubes. Swell for experimenting on latest circuits.
Special price.....ea. **$15.95**
Schematics are not available for these chassis; however, with some knowledge of TV they can be put into operation. These require tubes, yoke and alignment.

TERMS: F.O.B. Chicago, Ill. Cash with order or 25% deposit on C.O.D. orders. We will ship prepaid with additional $3.00 per unit ordered.

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Antenna Design

(*Continued from page* 44)

ohms, one full wavelength—90 ohms, four half wavelengths—130 ohms, and eight half wavelengths—154 ohms. The greatest dispersion from exact coincidence at 300 ohms is at the fourth harmonic, which is about one foot. This does not seem to materially affect operation if an antenna tuner is used to load the antenna.

Connection points which would be generally used are shown in Table 2. These are approximations, within three decimal places, which are close enough for practical purposes. In practice, the antenna is usually operated on frequencies that are above or below resonance so that any mismatch due to feeder point connection will either be improved or made worse, depending on its relation to the standing waves of the antenna.

Radiation Patterns

Any multiband antenna will have some change in radiation pattern between different bands. A horizontal half-wave wire will have the familiar figure-eight pattern with maximum radiation at right angles to the wire. Long-wire antennas will have beam characteristics with the maximum radiation approaching the plane of the wire as the order of harmonic goes up.

This characteristic is a detriment to those who want an all-band, all-direction antenna. If you plan to use your half-wave eighty-meter antenna on ten meters it behooves you to carefully plan the direction which the wire runs, because it will represent a long wire of eight half wavelengths. Table 3 shows the angle from the wire of the main radiation lobes for different wavelengths and disregarding feeder effect.

The off-center-fed antenna should give the same results as a dipole of the same length oriented in the same direction. But to get these results it is necessary to get the same power into the antenna from the feedline. It will be much easier to do this if some sort of antenna tuner is used to compensate for unbalances and out-of-resonant conditions that are bound to occur in multiband operation. Fixed impedance matching devices were used by the author to match the coaxial cable output of a "Viking I" to the 300-ohm transmission line and it was found that satisfactory loading and feeder balance was obtained only on frequencies near the optimum values.

-30-

Table 3. Angle from the wire of the main radiation lobes for different wavelengths and disregarding the effect of the feeder.

No. of Half Wavelengths	Angle of Max. Radiation	Power in Major Lobe (db)
1	90	1.0
2	55	1.15
4	37	1.35
8	27	2.1

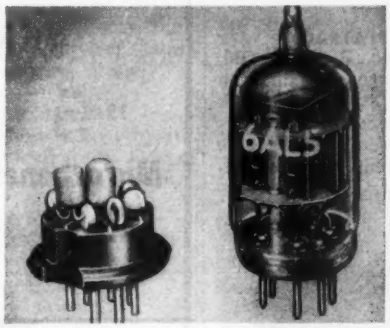
What's New in Radio

(*Continued from page* 128)

perages, and operating forces. Write the manufacturer direct for full details.

DUAL DIODES FOR TV

International Rectifier Corporation of El Segundo, Cal. has developed a small, compact plug-in selenium rectifier that is designed to replace the 6AL5 tube in many TV sync discriminator circuits.



The Type 60-7788 subminiatures are said to offer certain advantages over tubes since they are much smaller in size, do not require any heater power, and offer a high reliability factor, according to company tests.

The unit consists of two of the company's 1U1 selenium diodes, mounted and soldered to a plug that fits a seven-pin miniature tube socket. Each diode is designed to deliver 20 volts d.c. at 1.5 ma. for an r.m.s. voltage input of 26 volts max. and may be operated through an ambient temperature range of −50 to 100 degrees C. The diodes are completely encapsulated to protect them from moisture, corrosive atmosphere, and fungus.

Bulletin SD-1B, available from the company at no charge, gives complete details.

TUBE REJUVENATOR

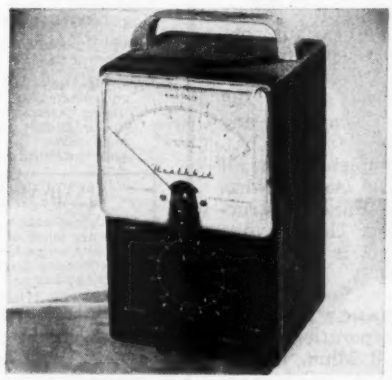
General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill., is now offering a new picture tube rejuvenator for the service trade.

Tradenamed "Zipt," the new unit is said to burn off picture tube shorts and thus lengthen the useful life of the tube. It takes only two minutes to do the job, repairing grid and cathode shorts without any need for chassis pulling. Electron emission is increased, with consequent restoration of the set's brightness control.

V.T.V.M. KIT

Heath Company of Benton Harbor, Mich., is marketing a new a.c. vacuum-tube voltmeter kit which is characterized by stability, broad frequency response, and sensitivity.

The Model AV-3 has been designed especially for audio measurements and low-level measurements in power supply filters, etc. It uses a cascode amplifier circuit with cathode-follower isolation between the input and the amplifier and between the output stage and the preceding stages.



Response of the AV-3 is essentially flat from 10 cps to 200 kc. and is usable for tests beyond these frequency limits. Increased damping in the meter circuit stabilizes the meter for low-frequency tests. Nylon insulating bushings at the input terminals reduce leakage and permit the use of the company's 5-way binding post.

Complete information on this new kit unit is available on request to the company. —30—

Mullard

AUDIO TUBES DESIGNED FOR HIGH FIDELITY

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Many years of research and development have been spent in producing a range of Audio Tubes to meet the requirements of High Fidelity sound reproduction in all respects. This is why MULLARD Audio Tubes are accepted in Great Britain as a standard by which others are judged, and why leading High Fidelity manufacturers in the United States also use MULLARD tubes in their equipment.

EL-34—Recognized as the finest high power output pentode, up to 100 watts in push-pull. Exceptionally linear, requires low input voltage.

EL-84—9-pin miniature AF power pentode, combining high gain and linearity. Up to 18 watts in push-pull.

***EL-37** Specialized manufacture of Mullard High Fidelity tubes, particularly the EL-37 assures longer life and increased balanced power output. Equivalent to 6L6, 5881, KT66.

***ECC83/12AX7**
***ECC82/12AU7**
***ECC81/12AT7**
Mullard quality double triodes with low hum, noise and microphonics.

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***GZ34** — Indirectly heated full-wave rectifier with 5v, 1.9 amp heater, 250 ma output. Equivalent to 5U4G/GA without circuit changes with the advantage of lower tube voltage drop due to unipotential cathode.

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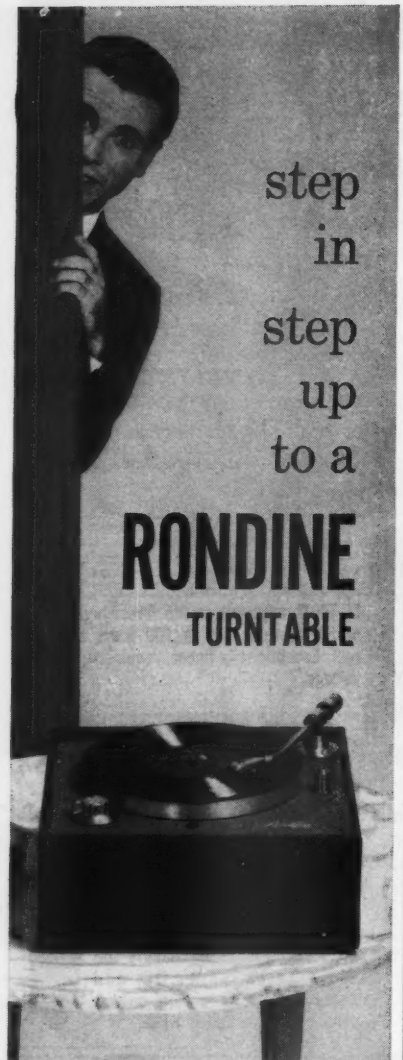

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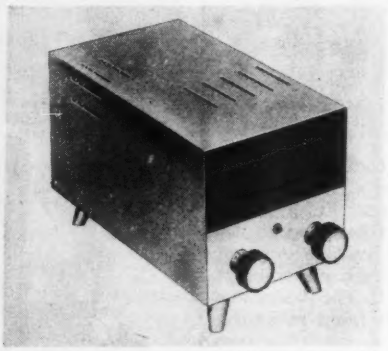
New Hi-Fi-Audio Equipment

STEREO TAPE PLAYBACK

David Bogen Co., Inc., P. O. Box 500, Paramus, N. J., recently introduced a simple stereophonic tape playback unit, the Model ST10.

Designed to provide stereo tape playback in hi-fi systems, the unit incorporates dual preamplifiers and a 10-watt amplifier in a single compact cabinet. When used with a tape playback deck the output of a stereophonic tape head is fed into both preamplifiers of the ST10. One of these drives the built-in amplifier (channel 1) and the other drives an external amplifier (channel 2) from a cathode follower circuit.



2-STATION INTERCOM KIT

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill., has recently released a two-station intercom which is being supplied as a low-cost "do-it-yourself" kit.

The package consists of a master station, remote station, plus 50 feet of interconnecting cable. The master unit combines both the volume control and "on-off" switch in one knob. The remote station includes a "press-to-talk" switch. The remote switch can be left in the "talk" position to permit continuous monitoring by the master station. Because only the master station is connected to a power source, the remote station can be located at any convenient spot.

The kit comes complete with all tubes, 50 feet of cable, solder, wire, all parts, and easy-to-follow instructions. It operates from 110-120 volts a.c. or d.c. The cabinet is finished in antique white.

HEAD MAINTENANCE KIT

EMC Recordings Corporation, 806 E. Seventh St., St. Paul 6, Minn., has assembled a special head maintenance kit for use by owners of tape recorders.

The kit contains "Long Life Cleaner" and "Long Life Lubricant," each

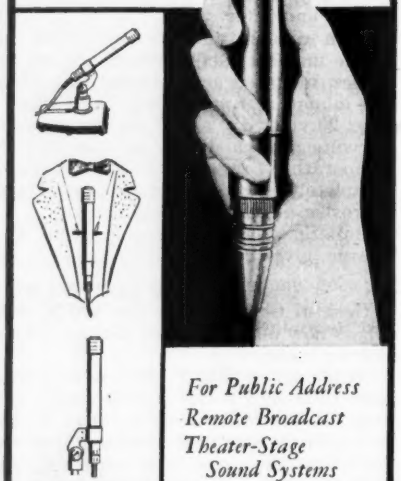
NEW $70.00

SHURE SLENDYNE

OMNIDIRECTIONAL DYNAMIC PROBE MICROPHONE

IS 5 Microphones IN 1

Model "535" List Price $70.00



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A completely versatile probe microphone of excellent frequency range (60-13,500) that combines ruggedness, beauty and reliability.

Versatility: Can be used (1) on a floor stand; (2) on a desk stand; (3) quickly removed for use as a hand-held microphone; (4) furnished with lavalier cord for wearing around the neck; (5) impedance switch permits use as high or low impedance microphone. Accessory on-off switch requires no wiring.

Ruggedness: Built to withstand hard usage and extremes of temperature and humidity.

Beauty: Slender, convenient shape, finished in brushed satin chrome.

Reliability: High efficiency magnetic materials and circuits assure years of consistent high quality performance. Shure quality control techniques result in an exceptionally high degree of uniformity for microphone interchangeability and multiple use.

SLENDYNE *Model "530"*

This deluxe version of the Slendyne has a frequency range of 50-15,000 cps and is furnished with a Cannon XL-3-11 broadcast connector. Strikingly attractive non-reflecting black and gold anodized finish.

LIST PRICE $110.00

The Mark of Quality

SHURE SHURE BROTHERS, INC.

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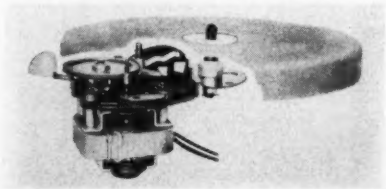
in the two-ounce size. Special brush applicators are supplied with the kit, as well as a complete head maintenance instruction manual.

The cleaner is designed to keep the tape recorder heads free from gradual accumulations of dirt, grease, dust, and magnetic oxide and binder. The lubricant, when applied to recorder heads, is said to prolong head life up to 200 per-cent. The thin layer of the special silicone lubricant effects the lowest possible friction between tape and head, thereby reducing wear.

COMPACT PHONOMOTOR

The Power Equipment Department of *Federal Telephone and Radio Company,* 35 Central Ave., East Newark,

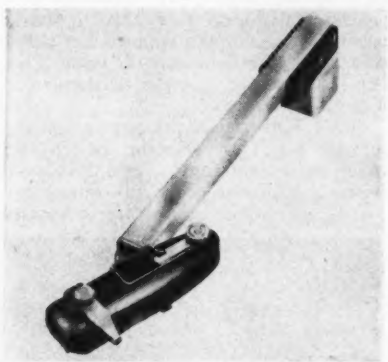


N. J., is now offering a lightweight, compact, and rugged three-speed phonomotor equipped with either a metal or a plastic 8-inch turntable and dynamically balanced friction drive.

The new phonomotor is for use in portable and small-sized phonographs. It is available for either 95- or 117-volt operation at 60 cycles. The unit has a unique idler wheel whose outer rim is pierced with tiny holes. Affixed to this rim is a rubber tire whose upper and lower edges are vulcanized to each other through the holes in such a fashion that the tire does not slip on the wheel's rim. This nonslipping feature eliminates flat spots due to uneven tire wear and prevents splitting of the tire. The unit is shock mounted.

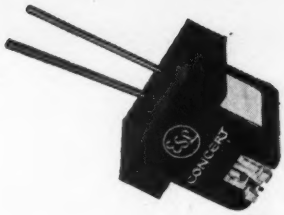
TRANSCRIPTION ARM

The Metzner Engineering Corporation, 1041 N. Sycamore Ave., Hollywood, Cal., has recently introduced a new transcription arm which features an exclusive "double-wrist-action"



head which is counterbalanced and has instant weight adjustment from 4 to 14 grams.

This special head provides minimum mass and insures perfect tracking and reduced record wear while the arm resonance is well outside the audible range, according to the company.



Give the BEST for Christmas

Which pickup is best? The ESL, reports The Audio League. After impartially testing nineteen leading cartridges, this authoritative report concludes:

"...The ESL Professional and Concert Series cartridges are by far the finest phonograph reproducing instruments we have heard."

"In A-B comparisons with its closest competitors, even persons who had never previously been exposed to high fidelity reproduction were struck by the superior definition of the ESL."

*"For sheer naturalness and undistorted ease, the ESL has no peer."**

Give the best for Christmas: give the ESL. Your own ears and records deserve this superlative *electrodynamic* cartridge, too. Join the professionals—switch to ESL. Free information upon request.

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**Authorized quotation No. 54. Please consult The Audio League Report, Vol. 3, No. 6-7 (March-April 1955) for the complete technical and subjective report. Additional information in Vol. 3, Nos. 10 & 12. Subscription: 12 issues $4, from P. O. Box 262, Mt. Vernon, N. Y.*

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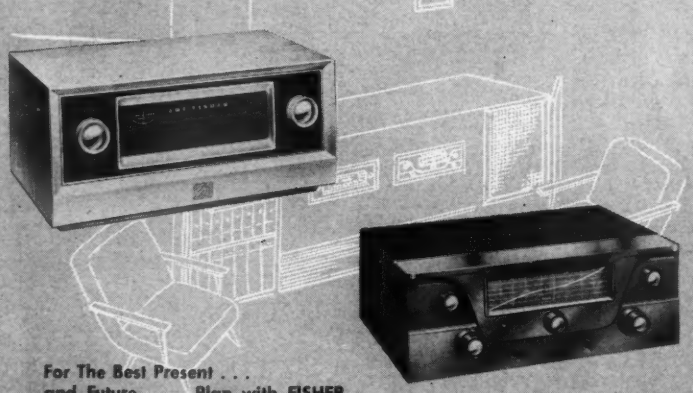
USUALLY . . . when a music lover purchases a FISHER high fidelity product, he does so for pride, for quality, for personal satisfaction. On the other hand, it is gratifying to know that—if he preferred—he could have chosen FISHER, *the* leader in the field, purely on the basis of *economy*. For it has been proven time and again . . . that FISHER . . . with the best in technological advancement and beauty of style, *is most practical* to own.



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■ A *NEW* FM Tuner — traditionally FISHER in quality, performance and design. Only $99.50 . . . the FM-40 represents the greatest value since the beginning of high fidelity . . . combining FISHER'S progressive engineering and exacting quality control at their superlative best! Center-of-channel meter for micro-accurate tuning. Sensitivity is 3 micro-volts for 20 db of quieting. Brushed-brass front panel. Only 12¾" x 7¼" x 4" high.
Less Cabinet, **$99.50**

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■ Features the most advanced audio control with *exclusive* FISHER ToneScope — you *actually* see all of the control settings! Full, clean 25 watts with less than 1% distortion! Direct tape-head playback and microphone preamplifier. Cathode follower, tape recorder output. Six equalization settings. Outputs for 4, 8 and 16 ohms. Ten tubes. Only 12¾" wide, 10⅜" deep, 5" high. *Frequency Response within 0.5 db, 10 to 90,000 cycles!*
$139.50

Write For Descriptive Brochure

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21-23 44th DRIVE · LONG ISLAND CITY 1, N. Y.

Finished in black and satin chrome, the "Starlight" arm mounts with a single hole and swivels on precision ball bearings. The arm lifts to a vertical position for easy cartridge replacement, is 12 inches long, and plays all record sizes up to and including 16 inch.

Full details on the arm and the company's companion turntable are available from Dept. 17 of the firm.

DYNAMIC VOLUME EXPANDER

Vidaire Electronics Mfg. Corp. of Lynbrook, N. Y., has added a dynamic volume expander, Model VE-10, to its line of hi-fi accessories.

The unit is designed to restore the original concert hall volume range

from whispered soft passages to powerful swells. Built-in indicators glow brightly when musical crescendos occur.

The unit may also be used as a volume compressor for home recording to prevent overloading or as a constant volume device to keep a constant sound output from the amplifier. The range of volume expansion and compression is up to 40 db.

30-WATT AMPLIFIER

Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass., has recently added a new "Dynaural" amplifier to its audio line.

The Type 210-E has a 30-watt power output on music; provision for two magnetic phono inputs; continuously variable damping control; and an improved dynamic noise suppressor with provision for rumble suppression only, scratch suppression only, or both. The noise suppressor operates without audible loss of music.

Other features of the new amplifier include an input selector switch for three high-level inputs, two low-level phono inputs, and one high-level phono input; an 8-position record compen-

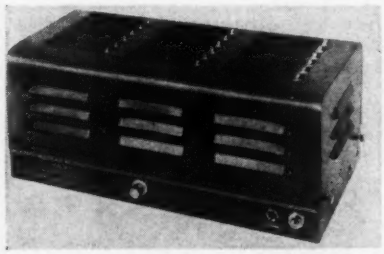
sator; frequency response flat from 19 to 35,000 cps with cut-off beyond to eliminate ultrasonic oscillation, and a special dynamic rumble suppressor

that can be switched out of the circuit.

Over-all size is 15¼" x 4¾" x 12½". The unit is supplied with a simple panel for custom mounting. A durable leather-finish plastic accessory case is available for table mounting if desired.

MULTIPLEX RECEIVER

Browning Laboratories, Inc., 750 Main St., Winchester, Mass., has de-



veloped a new multiplex receiver especially for background music and storecasting applications.

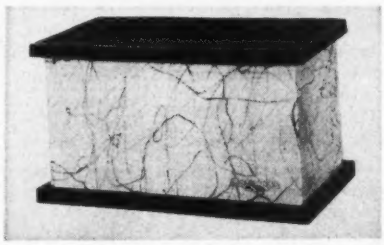
The main receiver portion is identical to the company's simplex units with the change from simplex to multiplex on any subcarrier frequency accomplished in the field by the substitution of the pre-tuned, plug-in multiplex adapter for the simplex unit.

The company will supply full details on these receivers upon request.

COMPACT SPEAKER ENCLOSURE

National Company, Malden, Mass., has recently introduced a low-cost space-saving speaker enclosure system which is being marketed as the "Synfonette."

Measuring a mere 8" x 14" x 9", the enclosure provides essentially flat fre-



quency response from 90 to 12,000 cps. The units are designed to be used singly in a horizontal or vertical position, wall or ceiling mounted, or may be used in pairs to provide added realism to sound *via* dispersion.

The units are currently available in blonde, walnut, mahogany, or ebony finishes.

NEW RCA COMPONENTS

The Theatre and Sound Products Dept. of *Radio Corporation of America*, Camden, N. J., has released two new components for home-assembled music systems.

The first item is a 12-inch dual loudspeaker (Type SL-123) with a frequency response of 40 to 18,000 cps. The second unit is a 10-watt amplifier (SVP-10-A) which incorporates a preamplifier and input selector.

The new components are electrically

Where Quality Counts...

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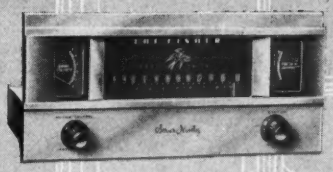
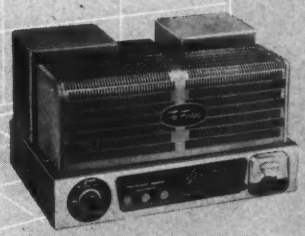


WHERE QUALITY COUNTS you will most often find THE FISHER components.

BECAUSE in the quality field more people buy FISHER than any other brand.



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FM Tuner · Model FM-90

■ The Finest FM Tuner Made! The FM-90 definitely sets the standards for the tuner of tomorrow . . . and outperforms any existing FM tuner! ▪ Micro-accurate tuning combined with extreme sensitivity and flexibility. ▪ Two meters indicate signal strength and center-of-channel. ▪ Extra-wide 1 megacycle bandwidth ▪ Full limiting on signals as low as 1 microvolt. ▪ 72 and 300 ohm antenna inputs. ▪ Interchannel muting control. ▪ Completely shielded and shock mounted. ▪ Outputs for Amplifier, tape and Multiplex. ▪ Cathode follower permits leads up to 200 feet. Less Cabinet, **$149.50**

THE FISHER

Master Audio Control · Model 80-C

■ Containing features found only in professional studio consoles — the Master Audio Control matches any power amplifier. ▪ Provides professional phono and tape-head equalization. ▪ Full mixing and fading facilities for from two to five channels. ▪ Seven Inputs. ▪ Two cathode follower outputs. ▪ Preamplification and equalization directly from tape playback head. ▪ DC filaments for non-measurable hum level. ▪ Self-powered. Less Cabinet, **$99.50**

THE FISHER

90 Watt Audio Amplifier · Model 90-A

■ A full 90 watts of gentle power . . . capable of reproduction characteristic only in THE FISHER. ▪ With less than ½% distortion at full output, the 90-A performs with breathtaking, life-like clarity. ▪ Two power supplies. ▪ Exclusive FISHER Performance Monitor for exacting operating conditions. ▪ Response within 0.1 db from 20 to 20,000 cycles. ▪ Power-take-off for unpowered auxiliary equipment. ▪ Exclusive Z-Matic. ▪ Output for 8 and 16 ohm speakers. ▪ Damping factor in excess of 16. **$229.50**

Write For Descriptive Brochure

FISHER RADIO CORPORATION

21-23 44th DRIVE · LONG ISLAND CITY 1, N. Y.

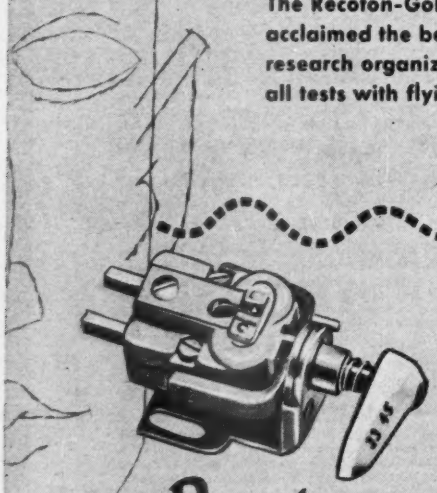
Another reason why today's fastest selling high fidelity record changer is **Collaro**

* **Automatic Intermix—**
7, 10 and 12-inch records may be played automatically, in any order and at all speeds—without pre-setting.

For other features and new popular price, see your hi-fi dealer or write Dept. QM-4
ROCKBAR CORPORATION 650 Halstead Avenue, Mamaroneck, N. Y.

the cartridge that scores 100%

The Recoton-Goldring cartridge was acclaimed the best by a national independent research organization, because it passed all tests with flying colors!



- Performance uniformly excellent.
- Cantilever - stylus - armature construction capable of rougher treatment than most moving-coil mechanisms.
- Will fit just about any American-made arm.
- Smooth and free of strain even on heavily recorded passages.
- Gives you more for your money. (Only $9.90 including 2 synthetic sapphire styli).

Model 500 SD— Sapphire/Diamond
Model 500 DD— Diamond/Diamond

Recoton-Goldring

"500" MAGNETIC TURNOVER CARTRIDGE

At leading hi-fi distributors, write for descriptive literature to
RECOTON CORPORATION, 52—35 Barnett Ave., Long Island City 4, N. Y.
Manufacturers of World-Famous Phonograph Styli.

matched and come complete with fittings for direct plug-in use with associated *RCA* hi-fi sound units. The units are now available from the company's sound products and customized high fidelity distributors.

HYPEX DRIVER UNITS

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill., is now offering a new series of "Hypex" driver units which are guaranteed for life.

The new driver units are designed for commercial, industrial, institutional, and p.a. applications. Frequency

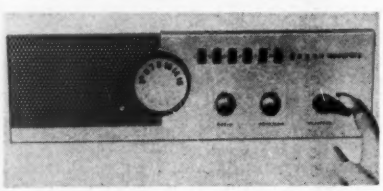
range is based on achieving substantially high conversion efficiency, higher power ratings, and improved reliability.

The D-30 is rated at 30 watts speech and music, the D-40 is a 40-watt unit, while the DD-100 is a super-power unit which will handle 100 watts. Write the company direct for full specifications on any or all of the units in the line.

"MUSIC-MONITOR"

David Bogen Co., Inc., 29 Ninth Avenue, New York 14, N. Y., is now offering a combination radio-intercom system which is being marketed as the "Music-Monitor."

This complete built-in system provides radio broadcast reception in six



rooms plus two-way voice communication between the master station and five remote stations.

The system is so designed that a housewife can answer the doorbell from the kitchen station, monitor the nursery, and talk from room-to-room without added steps. The Model RI6 is housed in a modern inconspicuous cabinet whose design blends with any decor.

AUDIO CATALOGUES

MILLS DATA SHEET

Mills Electro-Dynamics Corporation, 4133 Le Jeune Road, Coral Gables, Fla., is offering free copies of its new

6-page brochure covering a line of hi-fi systems.

The booklet pictures and describes five different models with an accompanying data sheet providing the specifications, prices, and available enclosures. Write the manufacturer direct for full details and a copy.

LANSING LEAFLET

James B. Lansing Sound, Inc., 2439 Fletcher Drive, Los Angeles 39, Cal., has issued a six-page, catalogue-type leaflet which provides descriptive and illustrative material on its line of enclosures, speakers, speaker systems, accessories, and allied items.

Products include dividing networks, several styles and models of enclosures, extended-range speakers, and high and low drivers. The leaflet is available without charge on request.

E-V SPEAKER CATALOGUE

Electro-Voice, Inc., of Buchanan, Mich., is now offering copies of its catalogue 118 for 25 cents each.

Entitled "How to Choose High-Fidelity Speakers and Components," the publication contains detailed information on building-block kits used to improve an existing hi-fi speaker system. The new catalogue supplements the firm's earlier publication, No. 117, "Guide to High-Fidelity Loudspeaker Systems." The two catalogues together provide a complete guide to the selection of speaker systems.

Orders for the catalogues should be sent, along with payment, direct to the manufacturer.

AUDIO-VISUAL CATALOGUE

Audio-Master Corp., 17 E. 45th St., New York, N. Y., is offering, without charge, a new 1957 audio-visual equipment catalogue for various classroom applications.

Printed in two colors, the booklet illustrates and details the company's line. Included in the special designs is a low-priced transcription unit for the playback of records up to 16 inches, an inexpensive record player for kindergarten and classroom use, hi-fi record players for music appreciation classes, as well as hi-fi transcription machines combined with p.a. systems.

ATLAS SOUND BULLETIN

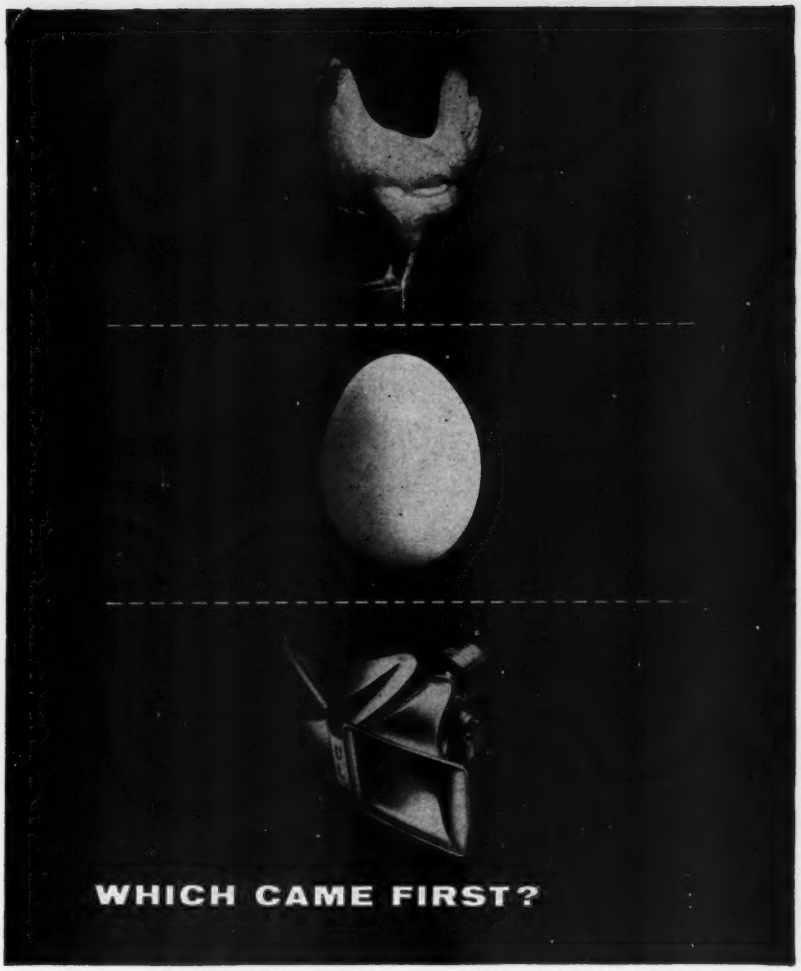
Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y., has published a single-page data sheet covering two new mike stands and a mike foot-switch.

Bulletin 756 provides complete details on the firm's Model SB-1, NS-1, and FS-1 units. The booklet is free on request.

SPEAKER SYSTEM PLANS

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill., is offering a new manual of construction plans which is available in two formats and under two manual numbers, 1060 and A-1060.

The contents of both publications are identical and include the selection



There's a lot of controversy about which came first, the chicken or the egg . . . but there's no question about the fact that University has been first with many of the most sensational developments in the loudspeaker field.

Merely being first is not enough. We, at University, subject every new product to the most rigorous laboratory tests, placing it on the market only when it has been brought to the peak of perfection. (Our customers have felt it was worth waiting for these "*proven*-firsts").

We've always enjoyed the challenge of finding new answers to old problems as well as exploring entirely *new* fields in audio engineering. Perhaps *that's* the reason University has become the leading manufacturer of specialized loudspeakers and components.

For the record—here are some of the "firsts" which we have engineered.

University was the FIRST to . . .

Pioneer high power reflex trumpets . . . now the industry standard

Introduce radial projectors . . . making full coverage still more economical

Achieve the one-piece integrally cast tone arm, reflector and bell **Cobreflex**—permitting durable construction of intricate designs

Offer wide-range response, breakdown and weatherproof driver units . . . bringing the **best in Sound** to public address

Devise **"rim-centered"** diaphragm/voice coil and magnet assemblies . . . eliminating need for shims and guides, ensuring shock and vibration-proof reliability

Depart from obsolete, erratic-performing multi-cellular and slit type diffraction projectors . . . by introducing the still superior "reciprocating flare" principle for **uniform** wide-angle dispersion of high frequencies

Make available **high efficiency** blast and submergence-proof speakers for p.a. and industrial applications . . . opening new markets to Sound installations

Combine driver and multi-match transformer in one unit . . . substantially increasing **versatility** of application and **flexibility** of operation

Conceive "progressive speaker expansion" (PSE) . . . **together** with specially designed components such as adjustable impedance voice coils, adjustable response woofers, adjustable crossover networks

and others too numerous to mention

LISTEN *University sounds better*

UNIVERSITY LOUDSPEAKERS INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

Altec Lansing Tuners

...Entertainment Unlimited!

With such high quality entertainment available on radio, it pays to select a tuner that will realize the full potential of modern broadcast quality. Altec tuners give this outstanding performance because they are designed and built by the skilled engineers and technicians who produce equipment for these same broadcast stations.

Every Altec Lansing tuner is backed by Altec's exclusive Performance Guarantee, your assurance that the tuner you buy will exceed its published specifications.

Ask to hear tested and guaranteed Altec Lansing tuners at your dealer's, or write Dept. 12-TM.

306A AM-FM BROADCAST TUNER

fm

maximum sensitivity: 1.1 microvolt
quieting sensitivity: 2.5 microvolts for 20 db*, 4.0 microvolts for 30 db*
frequency response: ± 0.5 db, 20-20,000 cps
distortion: Less than 0.4% at 1 volt output

am

maximum sensitivity: 3 microvolts
*standard 300 ohm antenna

price less cabinet $183.00; blond or mahogany cabinet $15.00

305A AM BROADCAST TUNER

output: 1 volt cathode follower
price less cabinet, $93.00; blond or mahogany cabinet $15.00

ALTEC LANSING CORPORATION

ALTEC FIDELITY IS HIGHEST FIDELITY

9356 Santa Monica Blvd., Beverly Hills, Calif.
161 Sixth Avenue, New York 13, N. Y.

of a kit, hints on speaker enclosure construction, and details for building the company's "Imperial," "Bass Ultraflex" (for 8, 12, and 15 inch speakers), "Tri-Plex," "Concerto-15," "Concerto-12," and "Duette" enclosures. Details on dressing up and finishing the cabinets are also included.

Complete working details and plans are an integral part of the presentation. Each of these booklets sells for 50 cents a copy. Either may be ordered from the manufacturer direct.

"IRISH" DECAL

ORRadio Industries, Inc., Shamrock Circle, Opelika, Ala., is offering an attractive identification decal to its recording tape dealers.

The two-color shamrock decal is designed to be used on store windows or on show cases where the recording tape is displayed. The copy reads "In stock—*'Irish'* brand recording tape." The company's familiar leprechaun is also included on the decal. —30—

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					4	5
						12
						19
						26

CALENDAR of EVENTS

NOVEMBER 28-29

Conference on Human Engineering, Hotel New Yorker, New York City. Sponsored by Manhattan College and Third International Automation Exposition in conjunction with International Automation Exposition at New York Trade Show Building. Details on Conference available from Richard Rimbach Associates, Room 359, 525 Lexington Ave., New York 17, N. Y. Registration limited to 200.

DECEMBER 5-7

Second IRE Instrumentation Conference, Biltmore Hotel, Atlanta, Georgia. Sponsored by Professional Group on Instrumentation and the Atlanta Section of IRE. Information available from M. David Prince, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga.

DECEMBER 6-8

Electronics Fair of Long Island, Exhibition Hall of New York State University in Farmingdale, Long Island. Sponsored by the Radio and Television Guild of Long Island. For information write to the Fair Committee, RTG of Long Island, Box 87, Bethpage, N. Y.

DECEMBER 10-12

1956 Eastern Joint Computer Conference, Hotel New Yorker, New York City. Sponsored by the IRE, AIEE, and Association for Computing Machinery. For registration forms, write 1956 Eastern Joint Computer Conference, Box 1599, Grand Central Station, New York 17, N. Y.

DECEMBER 19-20

RETMA Symposium on Applied Reliability, Bovard Hall, University of Southern California, Los Angeles, Cal. Sponsored by Radio-Electronics-Television-Manufacturers Association. For advanced registration, write RETMA Engineering Office, Room 650, 11 W. 42nd Street, New York 36, N. Y.

Ceramic Cartridge Amp.

(*Continued from page 59*)

tone control circuit, it can be loaded with a relatively low value of volume control, and it has inherently low distortion.

After the cathode follower come the tone controls. These are conventional type controls with one exception: They cause only one-half as much loss in gain. This is achieved at the expense of about 2½ db of boost on bass and treble, by making the divider ratio of R_7 and R_8 five to one instead of ten to one. The resistors R_{10} and R_{11} are required to make the flat response condition coincident with the mid-position of the controls. This is necessary since the controls themselves have a standard log taper.

The power amplifier section consists of a voltage amplifier stage followed by a floating paraphase inverter feeding two 6V6 tubes. The 6V6 tubes are run as normal beam tetrodes since the choice of load impedance as discussed before enabled the full 12 watts to be obtained with distortion as low as that obtained with screen loading.

The entire power amplifier section is conservatively designed. The output transformer alone weighs four pounds and uses grain-oriented steel. The amplifier will deliver the full 12 watts at any frequency from 20 to 20,000 cycles. As further evidence of the conservative design it is of interest to note that by merely substituting 5881 tubes for the 6V6GT tubes and a 5Z4 for the 5Y3GT the HFA-100 is changed to a 21-watt amplifier having only 0.2% distortion.

Although special custom-made transformers were used in the production models of the HFA-100, individual constructors have substituted commercially available units in home-built versions with excellent results. Both the *UTC* LS-63 (6000-ohm connection) and the *Acro* TO-270 have been used in the output, while the *Stancor* PC-3409 has been used for the power transformer. -30-

ADMIRAL 20A2 HINT

By JAMES A. McROBERTS

HUM bars appearing on the picture but not on the raster and in the sound as a modulation hum may be due to a defective aud.o tube in the Admiral 20A2 television receiver.

The audio output tube in this chassis supplies the sound second i.f. and some of the picture i.f. tubes with "B+" in the form of a stacked "B+" arrangement. The heater-to-cathode leakage in the audio output (V_{204}, a 6AS5 in the company's service data on this set) will consequently impose a ripple on the 'B+" supplied to the i.f. tubes via the cathode of the audio output tube.

The remedy is to change the tube and the justification for pointing out this obvious solution is to remind technicians that the audio output is part of the "B+" supply to both sound and picture i.f.'s. -30-

Control point of your home music system

It can truly be said that the "engineer" or control point of your home music system is the amplifier. And only with an ALTEC amplifier do you get the professional quality and superior design that provide years of flawless, trouble-free performance. Every ALTEC amplifier is built to the same high standards for which ALTEC loudspeakers and other ALTEC high fidelity components are world-famous.

Altec invites comparison. Investigation will prove to you that the Altec 440B preamplifier and the Altec 340A amplifier represent the highest development of electronic engineering. They are exceptional in performance, operation and their amazing flexibility of control. Through the use of most expensive professional components it is possible to provide simple circuitry that will continue to meet Altec's stringent specifications for years.

For further information regarding the finest in home music systems consult your Altec dealer or write Dept. 12TM.

340A POWER AMPLIFIER. 35 watts continuous, 30 to 22,000 cycles with less than 0.5% distortion. Frequency response within 1 db. 5-100,000 cps., Intermodulation less than 1.0% at 35 watts, 40 cps and 2 KC, 4:1 ratio...$159.00

440B CONTROL PREAMPLIFIER. Maximum flexibility with 12 controls, 25 record crossover combinations • five inputs: three high level, two low level • noise level at maximum volume better than 95 db. below 1.5 volts output • 1000 ohms cathode follower matched to 340A power amplifier... Price, less cabinet, $135.00. Blond or mahogany hardwood cabinet, $15.00.

These specifications—like the specifications for all Altec Lansing products—are *minimum engineering requirements*. This is your assurance that Altec products will actually meet or exceed their published specifications.

ALTEC
LANSING CORPORATION

ALTEC FIDELITY IS HIGHEST FIDELITY

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161 Sixth Avenue, New York 13, N. Y.

for

17 WATTS

PUSH-PULL POWER at 300 V. B+

with a pair of MINIATURE tubes

the

Amperex®

EL84/6BQ5

LOW-DISTORTION,
HIGH-GAIN POWER PENTODE

- True pentode characteristics for low distortion and high peak power.
- High gain and sensitivity resulting in reduced driver stage distortion.
- 12 watts plate dissipation in a miniature envelope.
- At 300 volts, capable of 17 watts at 4% distortion (without feedback) in Class AB push-pull pairs.
- 5.7 watts output at 10% harmonic distortion (without feedback) as a single-ended output stage.

OTHER **Amperex TUBES** FOR HIGH-FIDELITY AUDIO APPLICATIONS:

6CA7/EL34	High-power pentode; 100 W PP
EF86/6267	Low-noise high-μ pentode
ECC81/12AT7	Low-noise medium-μ dual triode
ECC82/12AU7	Low-noise low-μ dual triode
ECC83/12AX7	Low-noise high-μ dual triode
GZ34	Cathode-type rectifier; 250 ma.
EZ80/6V4	9-pin rectifier; cathode; 90 ma.
EZ81/6CA4	9-pin rectifier; cathode; 150 ma.

At All Leading Electronic Parts Distributors

Amperex ELECTRONIC CORP.
230 Duffy Ave., Hicksville, Long Island, N.Y.

Listening Tests

(*Continued from page 41*)

smooth at low volume and also maintain the same clarity without distortion at high volume.

With these listening tests you can usually narrow the choice of speaker systems down to about three or four in your budget and size ranges. If you wish to listen further, the author suggests tests with vocal, piano, organ, and "noise" records.

The voice test is based on the fact that we are all very familiar with the sound of the human voice in normal speech. If a speaker system can really sound like a live person's speech, it is very clean, smooth in response, and free from resonances. Try to pick up an FM station with a local live announcer. If you cannot do that, there are some wonderfully recorded speaking voices on the second side of the *Angel* recording of "The Merry Widow" (*Angel* 3501B). Adjust the volume so that it approximates the loudness of normal speech in the demonstration room. As you switch from one speaker to another, note which sounds most realistic. Listen for any trace of sound resembling speaking with the head in a box. The "box effect" is due to resonances. Differences in speaker systems on this test are often quite marked. A good, rugged enclosure is vital in obtaining a good rating on this test.

Now for the piano test. The piano is a very difficult instrument for a speaker to reproduce because piano notes are made up of a very powerful momentary ping followed by a complex harmonic resonance. In other words, the speaker cone must perform a powerful jump followed by a complicated pattern of vibration. The big jump must stop the instant the amplifier commands and the quiet tones must not be affected by the previous excursion of the cone. This is related to the damping characteristic and transient performance of the speaker. Two of the author's favorite piano test records are the *London* "Concerto in D" by Ravel (LL797) and the *Westminster* Rimsky-Korsakov "Piano Concerto" (WL 5068). As you compare speakers on piano music, listen for the sharp attack of the notes. The speaker with best transient response will give the best impression of the piano being in the room with the listener. Note the fullness and richness of the bass and the mid-range notes and the ring of the natural resonances of the piano. Try this test at a relatively high volume level.

The organ test is a measure of many qualities of a speaker system related to its ability to reproduce music. Power handling capacity and wide frequency response are important in good organ reproduction. A rather critical test of a speaker system is its capability in recreating the differences in tone color of different organs. On

DUOTONE IN LIFE

THE BIG NEWS IS DFF—"Duotone's Fidelity Focus" goes into "Life" and tells millions about the most sensational needle ever designed. DFF brings recorded music out of the shadows, into clear focus. Life readers will make the demand for DFF big. Send for free DFF promotional material today. Especially Duotone's home Needle-Tester. Don't delay. Demand will be great. Get free DFF kit and test cards, today.

THE DUOTONE COMPANY, Keyport, N. J.

Now! RCA Victor Hi-Fi "Mylar"* tape—super-strength, extra-long play!

Sells on length alone! Not 1200', but 1800' on a 7-in. reel! Extra-thin —superstrong! Also available: new RCA Victor acetate tape with full frequency performance—to be sold at a special low price! And new RCA Victor acetate tape with full High Fidelity response—same tape used for professional recordings. Sell RCA Victor—and you'll sell more tape!

*"Mylar" is a registered Dupont trademark for its polyester film.

RCA VICTOR
Trade® RADIO CORPORATION OF AMERICA
CAMDEN 8, NEW JERSEY

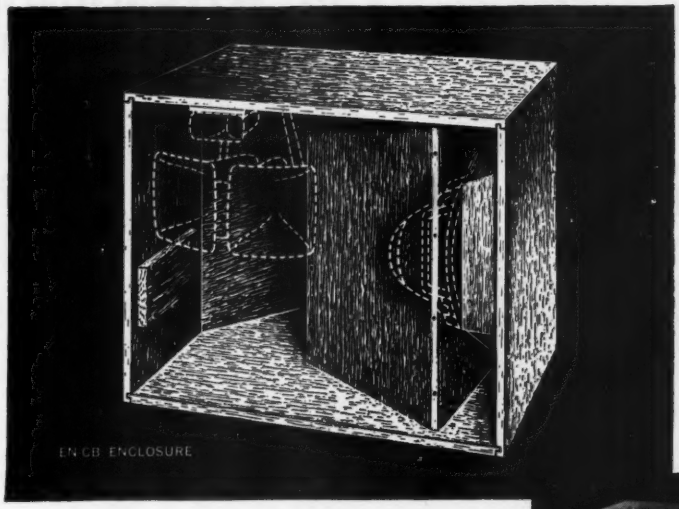
some speaker systems all organ records sound as if the same organ was used; but on other systems fine distinctions of tone are clearly revealed. This is determined by the speaker's ability to reproduce sound signals without imparting to the sound resonances and tone color of its own. For the organ test, the author recommends *Columbia's* Bach "Toccata in D Minor" played by E. Power Biggs (ML5032). This record is remarkable in that the same selection is played on a number of different organs, allowing just the type of comparison desired for this test. Two other excellent organ test records are the "King of the Instruments" by the *Aeolian Skinner Organ Co.* and an "Organ Demonstration" record by *Turntable Records* (HF-2). Listen for clear, clean organ tone. Note which speaker allows you to clearly recognize the difference in tone between the various organs. Listen for clear separation of the pipe tones. On a sustained chord, see how many different pipes you can count as distinct tones. Listen to the bass tones. On low bass organ notes you may notice as you switch back and forth between speakers that one speaker sounds almost as if it were reproducing the tone an octave lower. This is evidence that the lower tone speaker is one which produces less harmonic distortion on the bass frequencies. On a passage with a lot of bass pedal notes, listen for any tendency to overemphasize a single tone. This can indicate a strongly resonant bass frequency. Also listen for any blurring or lack of musical character on bass notes. The better the definition and the separation of the tones, the better the speaker will satisfy your ear on long periods of listening.

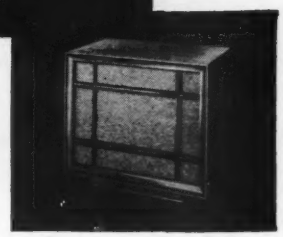
There are a couple of "noise" listening tests which are recommended for real hi-fi fans. On side B of the *Audiophile* record "Echoes of the Storm" (AP-20) there are some amazing recordings of some common sounds. One is the sound of water dripping and running into a bucket. Since we are all familiar with this kind of sound, it is a simple matter to close one's eyes and decide which speaker gives the best illusion of the real thing. The record also lets you try this on the sound of hammering nails and sawing wood. This noise test is quite sensitive and will often reveal differences in sound from two speakers which sound nearly identical on music for short listening periods. In order to reproduce these noises with a natural realistic sound, a speaker must have a wide frequency response with plenty of power handling ability at both low and high frequencies. It must also be free from resonances and be well damped, or it will sound like it is coming from a speaker in a barrel.

Your ear may be quite numb by this time but you will know more about speaker systems than you will learn in a year of reading specification sheets.

Remember the sound is the thing and the ear is the judge! —30—

have fun . . . save money





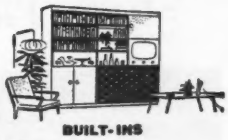
The famous University **CLASSIC** speaker system (shown at right), represents the highest achievement in audio engineering, the ultimate in sound! The CLASSIC is a true, folded, self-contained exponential horn which operates the woofer as a compression driver for maximum efficiency. Each detail has been so carefully worked out that the complete system functions as a beautifully coordinated team. A truly self-sufficient cabinet, it functions independently of walls and floor, achieving an amazing realism . . . almost like having a concert orchestra in your own home. The superb craftsmanship of the cabinet and high University standards to which the CLASSIC components have been built make the price really attractive. Mahogany $450.00, Blond $460.00.

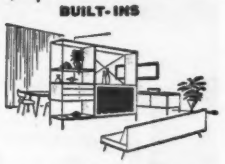
BUILD ONE OF THE FINEST SPEAKER SYSTEMS IN THE WORLD

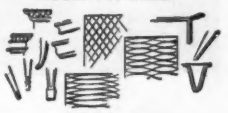
University has taken the *heart* of the magnificent CLASSIC system and made it available as the EN-CB UNFINISHED-UTILITY enclosure. It came about as a result of an overwhelming demand on the part of "do-it-yourself" enthusiasts who wanted to build their own CLASSIC system. The price of the EN-CB is only $120.00

The EN-CB is a superb piece of craftsmanship—constructed of Grade 1 Birch plywood using locked and mitred joints and braced with heavy glue blocks for maximum efficiency. Supplied with full instructions to mount speakers and network components. Designed acoustically to permit versatile use as "lowboy" or "highboy."

Naturally, *all* speakers sound better in an EN-CB. Recommended are CLASSIC components: C15W woofer, Cobreflex-2 mid-range horn with T-30 driver, HF-206 "Reciprocating-Flare" super-tweeter and N-3 ACOUSTIC BATON crossover network.


BUILT-INS


ROOM-DIVIDERS


PICK A PERIOD

CUSTOM FINISHING

The EN-CB is a boon to the home decorator who plans to custom build part of his furniture. Decorating ideas are limitless:

BUILT-INS—Easily installed into closet or wall, or into large wall-to-wall installations.

ROOM-DIVIDERS—Can be used vertically or horizontally.

PICK A PERIOD—Any furniture period can be achieved by treatment of front frame moulding, base, grille fabric, etc.

CUSTOM FINISHING—Can be stained and finished Blond, Mahogany, etc. Surface treatments: enamel, leather, formica, etc.

THE COMPONENTS THAT MAKE THE CLASSIC THE ULTIMATE IN SOUND

C15W HF-206 COBREFLEX-2 T-30 N-3

LISTEN *University sounds better*

UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

NEW

Pilot

High Fidelity TUNERS

Now Feature

*Beacon Tuning**

and

Modern Styling

Plus Advanced Circuit Design Features

***A Pilot Exclusive . . .**

Newly developed tuning indicator brings new ease and accuracy to FM and AM station selection.

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37-06 36th St., L.I.C. 1, N.Y.

Send complete details about new Pilot tuners with Beacon Tuning.

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Address.....

City.....**Zone**....**State**.....

FM Alignment Made Easy

By **HERBERT M. HONIG**

ALIGNMENT of FM receiver stages, as found in television sets and FM tuners, is frequently shunned by the service technician and the audio hobbyist because conventional procedures are complicated and require an elaborate set-up of test equipment. The author uses a very simple procedure which requires nothing more than an ordinary d.c. voltmeter (any multitester will do) and a few minutes to peak the tuning adjustments. This procedure has been applied to several different types of tuners and TV sets by the author and others, and has always produced a marked improvement in performance. In addition to increasing sensitivity it also eliminates distortion caused by the non-symmetrical response curve of a misaligned receiver. The technique has only been tried on sets with discriminators; it is not applicable to sets with ratio detectors.

Because the procedure is so simple, it can be followed whenever a tube is replaced. This will insure optimum set performance at all times. Although the technique cannot yield the precise alignment symmetry that a *correctly* executed conventional procedure will, it has been found that many sets, aligned by conventional techniques with alignment gear which is not quite accurate, were improved when aligned by the method to be described.

Note, when following this procedure, that most i.f. and discriminator transformers have the primary adjustment on top and the secondary adjustment on the bottom. Others have both adjustments on top, with the primary on the input side and the secondary on the output side.

Step 1: With the set connected for normal operation, but with the underchassis components accessible, connect the voltmeter across the first limiter grid leak resistor. (This resistor is usually connected between one terminal of the secondary winding of the last i.f. transformer and ground. It is bypassed by a small mica or ceramic capacitor.) Connect the meter to read a negative voltage, that is with the red (positive) lead grounded. If such connection causes the set to become regenerative, connect a .01 μfd. capacitor across the limiter grid leak resistor.

Step 2: If the set has a.f.c., disable the a.f.c. as follows: If an a.f.c. defeat switch is provided use it for disabling. If not, locate the d.c. connection from the discriminator to the a.f.c. tube (which is usually fed through one or two series resistors that form part of an r.f. filter) and temporarily short the a.f.c. line to ground. Do this at a point in the a.f.c. path which is isolated from the discriminator by a series resistor.

Step 3: Tune the dial to several stations and note which station causes the smallest voltage indication on the meter. Tune in that weak station and set the dial at the point which produces the highest meter reading, even though that point may produce a distorted signal.

Step 4: Starting with the primary i.f. transformer adjustment, and working through to the secondary of the last i.f. (limiter) transformer, tune all adjustments for a maximum meter reading. Repeat the tuning adjustments until no further increase in meter reading can be obtained. (If it is found that the adjustments tune broadly because of high signal strength, disconnect the regular antenna and use a short length of wire at one of the antenna terminals, or use the regular antenna with the antenna terminals shorted together, to reduce signal strength.)

Step 5: The best procedure for discriminator alignment depends upon the set. Accordingly, if the set has a.f.c. use Step 6. If the set has no a.f.c., but uses the type of tuning eye with a double rectangular presentation, use Step 7. For other sets, use Step 8.

Step 6: Tune the discriminator secondary until minimum distortion is heard. Restore normal a.f.c. If the meter reading changes, retune the discriminator secondary for maximum meter reading, disable the a.f.c., and note that the meter reading stays constant. Repeat this procedure until a constant meter reading is obtained as a.f.c. is restored and disabled. Restore a.f.c. and tune the discriminator primary for best a.f.c. action. Repeat the entire step until a constant meter reading, with a.f.c. turned on and off, and good a.f.c. action are both obtained.

Step 7: With the set tuned for a maximum meter reading, tune the discriminator secondary and primary adjustments until both rectangles on the tuning eye have the same height. Check to see that an undistorted output is obtained by the method described in Step 8. If this procedure fails to yield an undistorted output, use the entire procedure of Step 8.

Step 8: With the set tuned for a maximum meter reading, tune the discriminator secondary and primary until minimum distortion is heard. Observe the meter as the dial is tuned to one side of the point where the meter peaks and listen for the point where distortion is just heard. Record the meter reading. Tune to the other side of the meter peak until comparable distortion is heard. If the meter reading at this point is not very nearly the same as that previously recorded, the discriminator is not tuned symmetrically and audio distortion will result. Retune the discriminator secondary as required to make the two meter readings the same. -30-

Tape Recorder Amplifier

(*Continued from page 74*)

purpose. This simple oscillator will produce better than 40 db erasure at normal tape saturation. The bias voltage is a factor in the response and distortion of the recorded tape and should be rather carefully determined. This can be varied by choice of the value of C_{15}. The voltage should be at least that which produces maximum level when a 1 kc. signal is recorded on the tape. Professional machines obtain less distortion by using higher bias levels, as great as twice this value. For the usual adjustment, the erase voltage will be approximately 180 volts at 35-50 kc. oscillator frequency, with the recording bias approximately 100 volts. The final section of the function switch, S_{1B}, applies plate voltage to the oscillator tube when needed for recording.

The third use for the amplifier is as a two-channel mixer for public address applications. This feature was included without extra circuitry by making the function switch a three-position affair. For mixer uses, the mid-position of the switch acts to disable the erase oscillator and record amplifier output, while activating all input connections. Output is taken from the monitor amplifier. The headphone monitor position and level meter are both useful for this application and a signal of over one volt can be furnished to a p.a. power amplifier. The low impedance output of the cathode follower permits separating the mixer and the power amplifier by many feet without frequency attenuation.

Construction

The developmental amplifier, as constructed, is shown in the photographs. In this case, an aluminum chassis, 11 x 7 x 2 inches in size with front panel measuring 13 x 7 inches, proved to be of adequate size. All operating controls were brought out to the panel, with emphasis on a reasonably symmetrical layout. Microphone inputs are also available at the front panel, fitted with *Amphenol* series 75 shorting type connectors. The shorting connectors serve to ground the unused inputs to prevent hum pickup or open grid howls.

The a.c. power switches for the amplifier and the tape transport motor are arranged together with the pilot light and monitor phone jack at the upper left of the panel. The level indicating meter is at the center, with the function switch, equalization switch, and microphone input connectors filling the space to the right on the front panel.

The gain controls are evenly spaced along the lower section of the panel. From right to left, the controls are: mixer gain for channel one, mixer gain for channel two, monitor output gain control, and finally, a playback roll-off control. This latter control is used

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to reduce high-frequency response when playing noisy tapes, if desired. It consists of a one-megohm tone control, with switch, and a .01 μfd. capacitor in series, connected between grid and ground of the 12AX7 cathode follower stage. The switch is included to remove the control completely from the circuit when not in use. However, the roll-off was found unnecessary in the great majority of cases; consequently, it is not included in the circuit diagram.

Chassis layout is indicated in the photographs. The two 5879 preamplifiers were originally shock mounted, but this proved to be an unnecessary refinement as the tubes are particularly non-microphonic. Tube layout was such that the playback circuit is in line, behind the panel with the record circuit placed at a right angle behind the meter. The power supply occupies the left rear corner and the various electrolytic capacitors fill the remaining chassis space.

This layout proved satisfactory from a wiring standpoint. However, a few precautions might be pointed out to assist those persons who may wish to duplicate the unit. A ground bus is used, with all grounded components going to this bus rather than to the chassis. The bus, in turn, is tied to the chassis at one point only to help prevent ground loop difficulties and hum problems.

The power transformer and filter choke were of the metal encased type and no hum field troubles were encountered from this end. Shielded wire was used for all input leads and those going to the function switch. Point-to-point wiring was used throughout with tie lugs used to support components where necessary. Parts placement did not prove critical, but it is well to bear in mind that the unit is a high-gain audio amplifier and should be treated as such.

Radiation from the erase oscillator might prove troublesome, and it might be wise to assemble this stage in a small "Minibox" or other shielded subassembly which may then be attached to the main chassis.

Input and output leads are dressed close to one another because of the single record-reproduce head. The switching system disables all circuits whenever they are unused and no difficulties were experienced.

The recording level is monitored by a rectifier-type decibel meter. A surplus telephone-type db meter was used and proved satisfactory. It was necessary to build out the meter slightly to reduce its loading effect on the circuit. One of the small inexpensive vu meters currently available for recording would be better suited, particularly since the meter ballistics are adapted for audio work.

Connections for the a.c. as well as the erase and record head are made with small *Jones* plugs at the rear chassis lip. A separate ground lead should be used between the chassis and the motor frame. High level inputs, as well as the output connec-

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tions, are made with conventional *RCA* phono connectors. The amplifier is mounted in a metal cabinet for protection and, more important, for complete shielding.

Conclusion

The completed amplifier is remarkably noise- and hum-free, with a reserve of gain. Using a wide-range, high-fidelity system, no hum is noticed when playing tapes that have been recorded with the outfit. Tapes recorded with the unit and played back on professional recorders indicate that the response is close to NARTB standards. It is therefore possible to exchange tapes with other standard recorders without further equalization.

At present, there is a trend toward the standardization of tape recorder curves. It should be pointed out that the amplifiers have inherently flat response curves, with additional simple equalization circuits to produce the desired frequency characteristics. It is thus a simple matter to modify recording or playback equalization as needed for a particular head or to adjust to some future standard if desired.

The completed amplifier is most satisfactory in all respects and the quality of tapes indicates that good fidelity has been obtained over the range of 50 to 10,000 cycles. Of great importance is the fact that the entire outfit can be duplicated at reasonable cost. —30—

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By ROBERT C. FALLER

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Hermetically sealed vibrators should be used in regions where the humidity is high. This sealing retards corrosion of the contact points within the vibrator.

Non-hermetically sealed vibrators can be used in dry climates and will provide performance comparable to the hermetically sealed units under less adverse conditions. This type might prove desirable in units with notoriously short vibrator life, such as in mobile radio transmitters.

If it is possible to replace a hermetically sealed unit by one without this feature, it may represent a saving of as much as 50 cents or a dollar on each vibrator. Large organizations could realize a substantial saving if such a substitution could be made without impairing performance.

To check the possibilities of making such substitutions, one has only to look in a parts catalogue listing vibrators to find hermetically sealed and non-sealed units whose other characteristics and basings are the same. Direct substitution can be made easily and simply without any rewiring of circuits or other major alterations.

Of course, the conscientious technician will only make such substitutions when local weather conditions permit without detrimental effects. —30—

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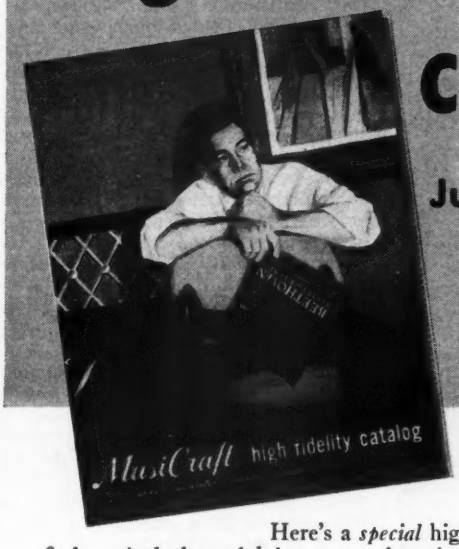

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(*Continued from page* 61)

lent on a 16 mm film reel will approximate this inductance. Little acoustical difference will be apparent when crossing over near the 900-cycle region provided each filter crosses over within plus or minus 15 per-cent of this frequency.

The use of a third loudspeaker physically located midway between the high- and low-channel speakers is recommended for the best obtainable quality from this system. The two-speaker combination, however, will satisfy many of the less critical listeners. The third speaker for fill-in is particularly recommended where the low- and high-frequency speakers are, of necessity, placed more than 12 feet apart. This speaker is connected through a suitable attenuator to the input of the network and is, therefore, intended to reproduce, at an appropriately lower level, the full range of the reproduced audio spectrum. Whether or not the third speaker is needed for broadcast listening may be determined by simple trial. The placement of a good quality radio set midway between the speakers and tuned to the same station should suffice for this purpose after the proper adjustment of its output level. Attention should be paid to the acoustical phasing of this third source. Interchanging the leads from the output transformer to the speaker terminals may be required to reduce "dead" spots or ear pressure sensation in the listening area.

A three-way dividing network might be used to some advantage but the method just suggested seems to work satisfactorily for home listening and may be accomplished with somewhat less complication and expense than if the more elaborate method were to be adopted. —30—

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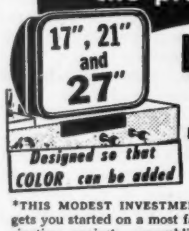

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(*Continued from page 67*)

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Campoli, violinist, with London Philharmonic Orchestra conducted by Sir Arthur Bliss. London LL1398. RIAA curve. Price $3.98.

London has begun an interesting series of recordings of the works of Arthur Bliss, a contemporary English composer whose works are beginning to be performed with some frequency. Adding authenticity to the occasion, they have Sir Arthur himself in the role of conductor. Campoli, our single-named virtuoso to whom the Concerto is dedicated, assays the difficult violin part with seeming ease and great tonal beauty. The work itself might be described as an odd admixture of romanticism and atonality. Neither element is very obtrusive, the interweaving of these characteristics creating what is certainly a composition modern in concept, but without the harsh contours so often a part of such works. In other words, it is highly listenable and sonically quite exciting. Bliss has incorporated a number of cadenza in his score, which give Campoli a chance to display his nimble-fingered dexterity. Bliss carries off his conductor's duties admirably as testified by the excellent playing he gets from the LPO and the splendid balance he maintains between orchestra and soloist.

The "Theme and Cadenza" is a short piece . . . an interesting trifle used as background for a radio play. The *London* engineers have contributed sound of dazzling opulence. For you lovers of the violin concerto, this is recommended as a stimulating change from the Mendelssohn, Tchaikovsky, et al.

BLISS
A COLOUR SYMPHONY
INTRODUCTION AND ALLEGRO
London Symphony Orchestra conducted by Sir Arthur Bliss. London LL1402. RIAA curve. Price $3.98.

More Arthur Bliss from *London* and this time his highly interesting "Colour Symphony". The four movements are entitled, "Purple, Red, Blue, and Green". The work is somewhat programmatic, Bliss having composed it after reading a book on heraldry and thus he titled each movement according to the symbolism of each color. As you might expect, the scoring is quite exciting and as a hi-fi vehicle doubly so. The orchestration is large, very rich and the *London* engineers had a fine time recording this. Here, again, Bliss shows his considerable skill at the podium and elicits a bravura performance of his score. Hi-fi fans with jaded tastes will like this and really wake up when the six tympani in the finale go into action! The brief but lovely "Introduction and Allegro" fills out the second side nicely.

FROM THE ROMANTIC ERA
Laurindo Almeida, guitarist. Capitol P8341. RIAA curve. Price $3.98.

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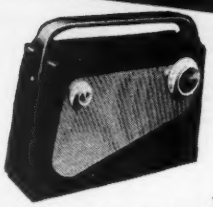

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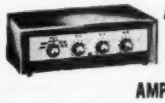

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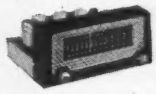

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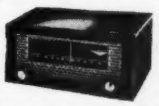

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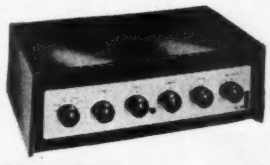

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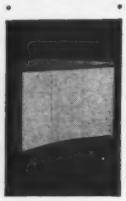

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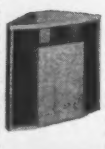

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scriptions of any kind should have no quarrel with this. Almeida displays fastidious taste throughout the disc and it is always a pleasure to hear his warm, clean-toned playing. As is usual with this artist, *Capitol* has afforded him the quintessence of good clean guitar sound coupled with its superbly quiet surfaces.

MOZART
DIVERTIMENTO #7
DIVERTIMENTO #1
TWO MINUETS AND CONTRA-DANSES (K.463)
Salzburg Mozarteum Orchestra conducted by Ernest Marendorfer. London LL1427. RIAA curve. Price $3.98.

This is a perfectly delightful record, containing 3 miniature Mozart masterpieces. They are all light fare very easy on the ear, beautifully performed and superbly recorded, except for a slightly too large acoustic frame. Marendorfer is completely unknown to me, but if he manages the same fine work in subsequent recordings I predict a wider acquaintance with him.

CHERUBINI
REQUIEM MASS IN C MINOR
NBC Symphony Orchestra conducted by Arturo Toscanini with Robert Shaw Chorale. Victor LM2000. RIAA curve. Price $3.98.

Many the Toscanini enthusiast who has been waiting for this release! Taken from the *NBC* broadcast of February 1950, the sound has the unmistakable "8H" quality about it although the *Victor* engineers have tried to help matters of range and acoustics. The Cherubini "Requiem" is a magnificent work and fully deserves both the resurrection and loving performance afforded it by Maestro Toscanini. This is music-making of very high order and belongs on the same exalted plane as the Maestro's Beethoven "9th" and "Missa Solemnis". As noted, the sound is dated but is still more than adequate. This disc deserves an honored spot in the library of any true music lover.

Stereophonic Tape Review

TCHAIKOVSKY
PIANO CONCERTO #1
Emil Gilels, pianist, with Chicago Symphony Orchestra conducted by Fritz Reiner. Victor ECS8 stereophonic "stacked" tape. 7" reel, 7½ ips, NARTB curve. Price $14.95.

This is a case where superlatives fail . . . no description could possibly convey to you the fantastic quality and the incredible musical experience this tape represents. To appreciate what I mean you must hear this! Anyone who says he does not like and can resist the blandishments of stereo after listening to this tape is either deaf or a phony poseur! This is beyond all question of doubt the finest stereophonic tape yet. Somehow, I missed this particular performance on disc and thus the fabulous pianism (admittedly aided by stereo) of Gilels left me breathless with surprise. For my dough this Gilels fellow wins the Tchaikovsky concerto sweepstakes in a walk! This was Tchaikovsky in the old-time grand manner. Such thundering peroration and flamboyant virtuosity I haven't heard in many years. Once again I will confess that it is quite possible my perspective of the performance was greatly colored by the stereo, but this is something I suspect that we will have to accept as part of the process in listening to a really good stereo recording. The directionality of the sound was outstanding, the "hole in the middle" very minimal here. With the superb acoustics of Orchestra Hall, the word for the piano and orchestral sound was *big*! I have

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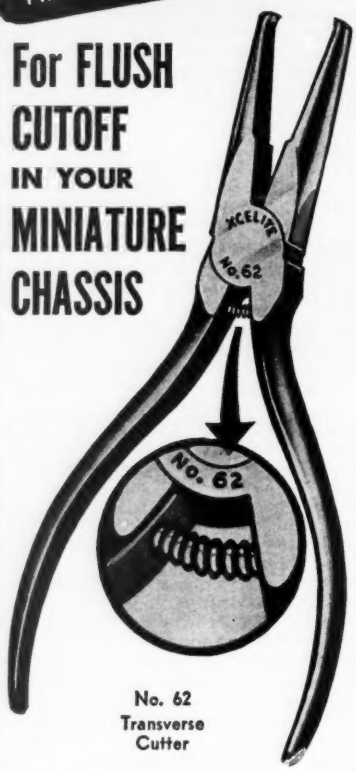

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never heard such a huge "liveness", yet there was an infinitude of inner detail. You might think with a weary, hard-ridden warhorse like this that you long since have committed to memory every note in the score, but believe me, the stereo revealed not only every note, but shadings and phrasings and nuances of performance, quite impossible to realize on a disc. The piano itself, the strings, brass, and especially the woodwind are reproduced with the fullest, widest frequency and dynamic range yet to appear on tape. Well, I could rave on and on, but let me say this . . . anyone calling himself a music lover should somewhere, somehow try to hear this stereotape. –30–

New Emerson Color Sets

(*Continued from page* 69)

holders located near the power transformer and accessible from the rear top of the chassis protect the power transformer secondary and the four selenium rectifiers. Two more fuses, in the form of loops of #26 wire, are in series with all filaments except the separate winding which supplies the color kinescope. Still another fuse is connected in series with the 400-volt line going to the horizontal damper and "B+" boost circuit. The presence of these fuses can be a great help to troubleshooting, especially when power or h.v. failure is indicated.

A simple a.c. line filter is employed between the a.c. interlock and the power switch and transformer. This filter consists of two capacitors and a resistor, each capacitor going from one side of the line to the chassis.

The new *Emerson* color TV receivers use the same basic color circuitry as *Admiral, Hoffman,* and others, but, from the service technician's point of view, many different features are apparent. Mechanical mounting of all major components, especially the picture tube, is quite different. The chassis and picture tube can be removed together from the cabinet for servicing. While still in the cabinet, the removal of the back, top cover, and under-chassis plate, as well as the location of so many of the other adjustments under the front sub-panel will greatly facilitate set-up and troubleshooting procedures in the home. –30–

CROSLEY MODEL 412 HINT

By JAMES A. McROBERTS

WHEN weak picture and poor sync showed up in the Crosley Model 412 it was decided that the trouble could be caused by a partial drying up of either of two electrolytic capacitors in the stacked "B+" supply for the 150-volt bus.

If either capacitor C_{140A} or C_{140B} (on the manufacturer's service diagram) increases its leakage resistance by an appreciable amount the voltage on the 150-volt "B+" bus will be lessened so that the sync and the picture sections of the set will be fed lowered "B+" with weakening of the picture.

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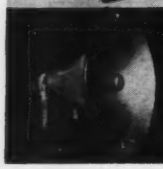

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Timer for 1 Mil Tape

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By **RICHARD H. DORF**

THE writer's mail has indicated that quite a number of RADIO & TELEVISION NEWS readers have equipped their tape recorders with *Veeder-Root* counters, as described in the September 1953 issue of the magazine (page 51). In conjunction with the timing graph included in the article it is possible not only to locate sections of tape rather exactly, simply by running until the proper number comes up on the counter, but also to time recorded material by knowing the counter numbers at which the material begins and ends.

A new improvement in tape recording, however, has made the old timing graph obsolete for many users, including the writer. The new 1-mil-thick tapes build up to a different outside diameter on the takeup reel for a given amount of time, so new timing data is needed. It is provided here in the form of a simple gadget which any reader can make from available materials.

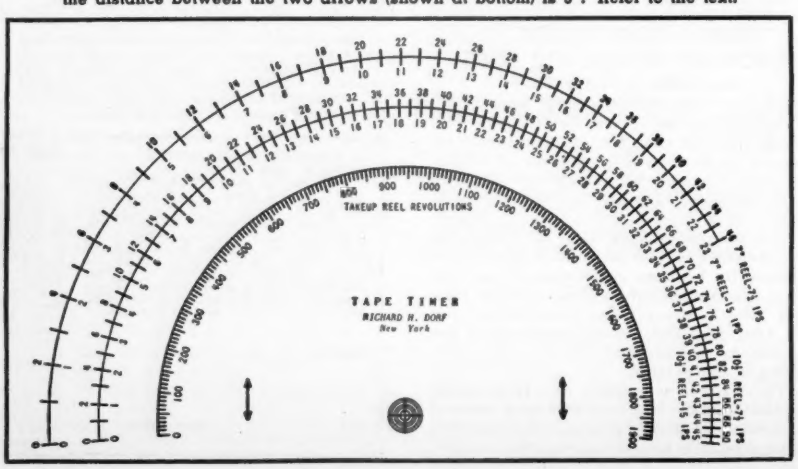
The fact that the new tapes are only approximately two-thirds as thick as the old 1½-mil-thick tapes means that 50 per-cent more tape can be accommodated on standard 7-inch reels when the new 1-mil tape is employed.

The result is that a 7-inch reel, which formerly would go for only 15 minutes at 15 ips, will now play for about 22½ minutes; a 10½-inch reel is good for 45 minutes at the same speed, which means that just about any musical selection or radio or TV program can be recorded on a single reel with the highest audio quality.

To use the timing device you must have a *Veeder-Root* counter coupled to the takeup reel. As described in the 1953 article, the easy way to do this is to mount it on a brass rod so it rests near the takeup spindle. Fasten a rubber eyedropper bulb to one end of a short piece of light spring and push the other end of the spring over the counter shaft. Then just slip the rubber bulb over the spindle when the counter is to be used.

Since the diameter of the tape winding is always changing with the amount of tape being wound, the time

Template for making timer dial. It should be enlarged (by photostating) so that the distance between the two arrows (shown at bottom) is 3". Refer to the text.



for a given number of turns becomes less as the reel gets fuller. Thus a conversion chart or device is needed to give timing as a function of reel revolutions.

A graph is one obvious way to do this and it was used with the earlier article. However, after long use the writer began to be annoyed with the time and attention required to trace from the vertical and horizontal axes to the graph lines and with the visual difficulties of interpolation. So, when it became necessary to do the job again for the new tape, a simple, almost automatic, indicator was devised.

The necessary "artwork" for the tape timer is reproduced in the illustration. Either cut this out of the magazine or have it photostated; then paste it down flat on a piece of Masonite. Cut down the Masonite so the piece is just slightly larger than the drawing.

Now take a piece of Plexiglas about 1/16 inch thick and around one-half inch wide. Cut it to a length about one-quarter inch greater than the distance between the bullseye in the drawing and any number on the outer arc. Scribe a line lengthwise on the piece halfway from each edge and for the full length of the Plexiglas. Fill this with a blackener—India ink will work. (If you want more precise readings, just used the scribed line, but this is a little harder on the eyes when you are in a hurry.)

Now drill a hole to fit a 6-32 screw right on the scribed line and a quarter-inch from one end. Drill a similar hole squarely in the center of the bullseye. Put a 6-32 screw through Plexiglas and bullseye, fastening it on the other side with a nut and spring washer.

To use the timer rotate the Plexiglas indicator to place the scribed line directly on the appropriate counter number on the inner numbered arc. Then simply read the time from the appropriate scale. The innermost arc covers 10½-inch reels for the two speeds, the outer, 7-inch reels. They are different because of the differing hub diameters.

This device is very easy and quick to use. Interpolation is quite simple, both for counter numbers and for times. Accuracy is about 5 seconds each way at 15 ips for recorders which run at correct speed. Where the recorder does not have a synchronous motor and runs at a substantially different speed from the standard, it is a simple matter to paste a cut-out piece of paper over the two outside arcs, draw the arcs on the covering paper with a compass or by tracing, and make new timing marks based on running a tape through with a piece of paper and an electric clock or stopwatch at hand. For best durability, it is a good idea to spray the finished gadget (after pasting the paper on the Masonite but before adding the Plexiglas indicator) with several thin coats of *Krylon* or another clear plastic. —30—

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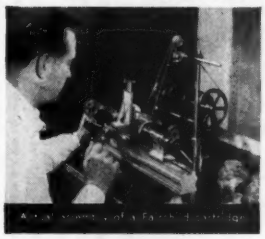
FAIRCHILD

PRECISION



The marked similarity between the watchmaker's art and the craftsmanship required to produce a precision cartridge can be aptly illustrated by an examination of the famous FAIRCHILD Micradjust Cartridge.

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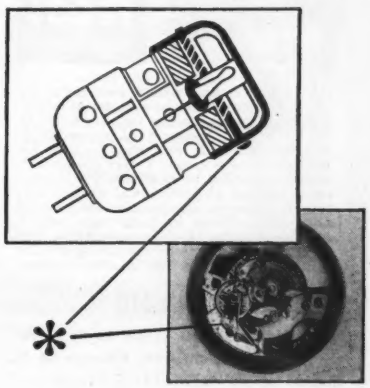

Write for details on FAIRCHILD audio products.

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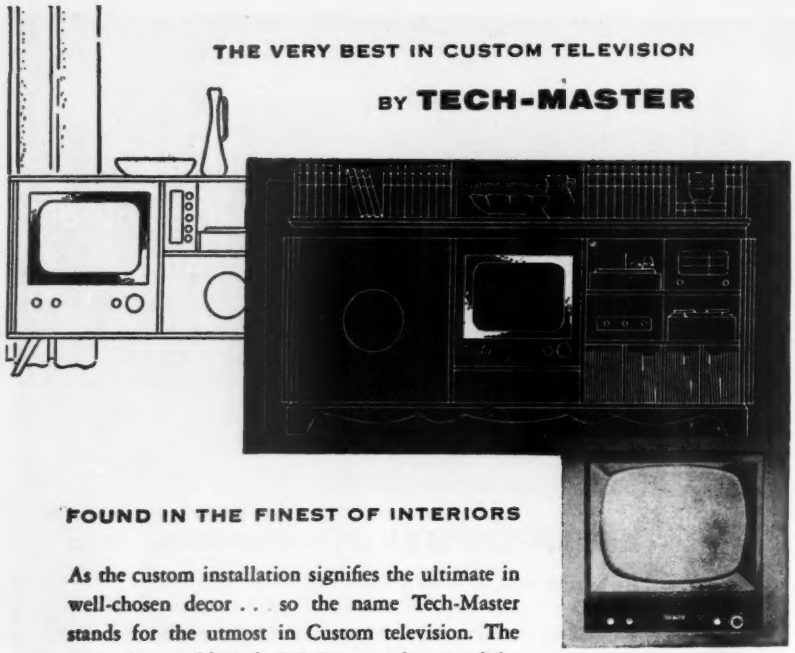

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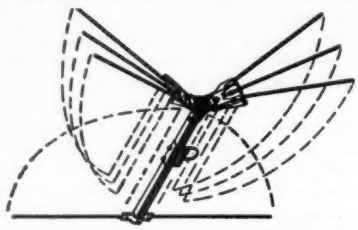
Antenna News

"QUICKIE" CONICAL

Telrex Laboratories, Asbury Park, N. J., announces its new high-performance "Conical-V-Beam," which is aimed at the replacement market as a low-priced, simple-to-install, durable antenna. No plastic substitutes are used in the all-aluminum design, which includes aluminum butterfly clamps and doweled tubular elements. The radiator swing clamp assembly automatically positions the elements; a snap-in positioned-reflector assembly provides positive locking. The antenna

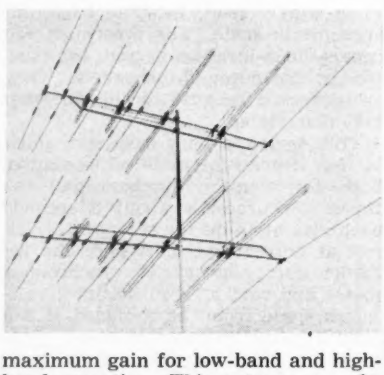


is available in single-bay form (Q-2X), 2-bay stack (Q-4X) or 4-bay stack (Q-8X).

This manufacturer announces three more patent license agreements, with *Lance Manufacturing Co., Tenna Manufacturing Co.,* and *General Cement Co.,* covering the manufacture of conical antennas.

ALL-CHANNEL YAGI

Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 62, N. Y., is currently producing a new antenna, the "Big Big Shot," Model BBS-400. Separate elements are used to develop

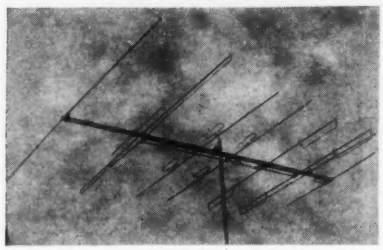


maximum gain for low-band and high-band operation. This antenna may be stacked for increased gain.

HIGH-GAIN ANTENNAS

Technical Appliance Corporation, Sherburne, N. Y., is introducing a new series of high-gain broadband antennas, the "Topliners." The streamlined design of these four antennas minimizes wind resistance, requires less mast bracing and guying. Also featured is "Auto-Lok" construction to

speed installation time. The antennas are built around a new connecting delay line called the "Power-Pack," which maintains optimum impedance match to the transmission line and a single-lobe pattern throughout the v.h.f. band. Essentially, this line is a balanced "T" section composed of inductive series elements and a capacitive shunt element. Mechanically, this section is made up of the antenna elements and four heavy aluminum coils.



Characteristics are reported as combining high gain, sharp directivity, high front-to-back ratio, plus uniform gain within individual channel bandwidths for good results with color transmissions. Four models, ranging in order from one designed for metropolitan and suburban use to a fourth intended for deep-fringe installations, are the "Topliner" '40 (Cat. 2540); the '50 (Cat. 2550); the '60 (Cat. 2560); and the '70 (Cat. 2570). For stacking purposes, there are factory tuned lines to fit all models.

6-POSITION INDOOR ANTENNA

Snyder Manufacturing Company, Philadelphia, Pa., has a 6-position indoor antenna on the market that uses a convenient slide-switch in its base instead of the more familiar knob. A criss-cross phasing element and 3-section staffs are used, with an extra-heavy topple-proof base. The antenna is available in aluminum as Model 66A or polished brass as Model 66B.

Ben Snyder, company head, reports that huge antenna towers in the fringe area may become a thing of the past. The development of powerful antennas, which are very compact and look almost like present metropolitan antennas, is definitely feasible in the light of recent research.

SALES CAMPAIGN

The Winegard Company, Burlington, Iowa, as part of a national promotion to introduce its line of 1957 TV antennas, is offering a guarantee of picture improvement. Also featured is the simplified "Umbrella-Ease" installation made possible by the fully factory assembled models. Dealers will be supported by an expensive consumer advertising campaign conducted in leading general-interest magazines. This

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campaign will stress the importance of good outdoor antennas in preparing for the color TV era, and will also highlight the complete installation packages, including necessary parts

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A 20-page local merchandising package, issued as a sales aid to dealers, contains a wide assortment of newspaper mats, spot radio messages, and other aids.

FM-TV COUPLER

Clear Beam Antenna Corp., Canoga Park, Calif., offers its model FM-TV 2SC to eliminate the need for a separate FM antenna where an all-channel v.h.f. antenna is already in existence for use with a TV receiver. This 2-set coupler, which can be used to feed two television receivers or one FM and one TV receiver from a single antenna, is of all-weather construction for indoor or outdoor mounting. The lead-in from the antenna is fed to one connection on the coupler; separate outputs are taken from two other con-

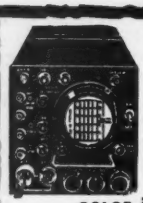
nections. The manufacturer also claims low loss, minimum interaction, and no distortion.

Also recently introduced is model H5, a conventional rabbit-ear indoor antenna aimed at the low-price market.

HIGH-GAIN V.H.F. ANTENNAS

The Kay-Townes Antenna Company, Rome, Ga., reports on field tests of its new "K" series of antennas in which the K9 outperformed stacked 1-element yagis.

Available in two models—the K9-1



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and K9-2—this antenna is stated to have high level gain across the v.h.f. band necessary to good color reception. It is a small in-line 9-element array. Also in the series is the K3, designed for metropolitan use. All "K" antennas feature a molded insulator with good weather characteristics and a new snaplock system to insure rigidity.

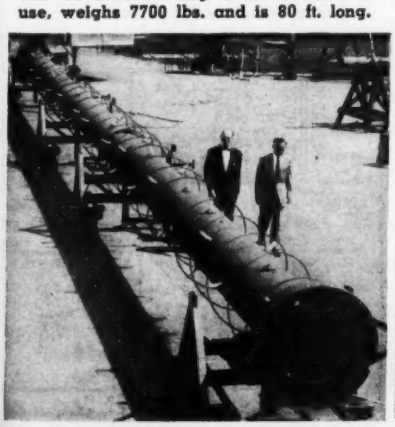
ONE-MAN ROOF MOUNT

Rohn Manufacturing Company, 116 Limestone, Bellevue, Peoria, Ill., is now offering a specially designed, cast roof mount that snaps into place when upright, then may be locked into position merely by the tightening of a hinge bolt. With this feature, it is reported that one man can install a mast quickly.

AUTO ANTENNA PATENT GRANT

Insuline Corporation of America, 186 Granite St., Manchester, N. H., announces the fact that it was issued patent No. 2758151 covering its original universal mount "Ball-Tenna" auto aerial on August 7, 1956. This manufacturer has announced his intention to take legal action regarding other antennas that may infringe on the patent. —30—

This giant v.h.f. helical television-station antenna is designed to transmit high-powered TV signals. Developed by G-E broadcast engineers, the rugged antenna is the simplest and the largest of its type to be manufactured. The new three-bay helical antenna requires only 10 feedpoints for power and de-icing. The antenna, which will be mounted atop a tower when in use, weighs 7700 lbs. and is 80 ft. long.



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A ZIFF DAVIS PUBLICATION

TRANSISTOR A.C. Power Supplies

By **HAROLD REED**
Research and Engineering
U. S. Recording Company

A series of low-voltage rectifier circuits using germanium crystals to provide d.c. voltages for transistor circuits.

ALTHOUGH we usually think of transistors as being battery operated devices because of the small power requirements, it is, of course, possible to operate them from a.c. power supplies. This is convenient, especially in experimental work.

Conventional a.c. power supplies may be used, but they usually operate at voltages higher than the potentials needed for transistor circuits and means must be provided to reduce the voltages to the low values required. This, certainly, is an uneconomical arrangement. In experimentation it is also desirable for supply voltages to be made variable.

An extremely simple a.c. power supply is shown in Fig. 1A. A single 1N34 germanium crystal diode functions as the rectifier. With the parts values shown, the d.c. output when powering a transistor oscillator circuit using a single CK722 was recorded at 12 volts. Increasing the value of R_2 with respect to R_1 will result in greater d.c. output voltage, while decreasing R_2 will reduce the output. However, care should be exercised to proportion the values of these resistors so that not more than 20 volts a.c. appear across R_2 in order to avoid ruining the diode. Currents up to 50 ma. can be handled by this circuit. It can be seen that there is little filtering of the pulsating d.c. rectifier output and a hazardous shock condition exists since one side of the 117-volt a.c. line is common to the d.c. output.

A better arrangement is shown in Fig. 1B. Here, an inexpensive isolation transformer is added to the circuit. Such isolation transformers are available as shown or with secondary voltages up to 150 volts. Standard filament transformers can also be used for this purpose and are available with secondary potentials from 2½ to over 20 volts. They may be selected according to the d.c. output voltage required. See Fig. 2A.

In any of these circuit configurations a 1N34 can be employed satisfactorily providing the a.c. voltage across R_2, or the voltage across the secondary winding of the transformer

Fig. 1. (A) A simple a.c. power supply using a single 1N34 crystal diode as the rectifier. The d.c. power output is approximately 12 volts. See text. (B) An improved version of the circuit of (A) using an inexpensive isolation type transformer.

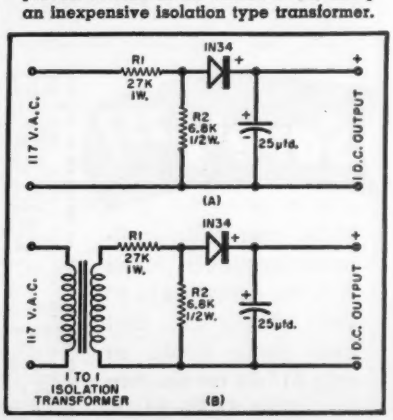
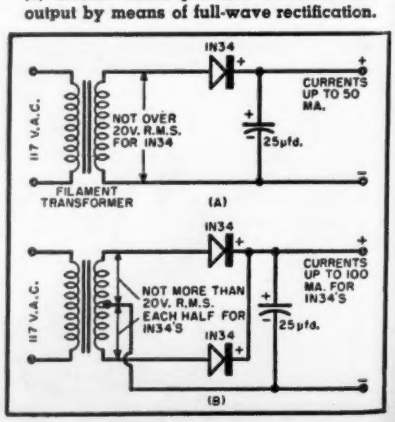


Fig. 2. (A) The same circuit as Fig. 1B except that a standard filament transformer is used. Type of unit selected depends on d.c. output voltage required. See text. (B) Circuit which provides smoother d.c. output by means of full-wave rectification.



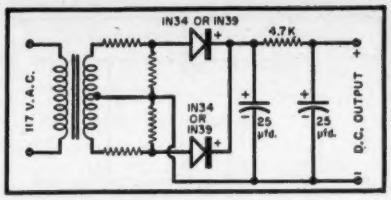


Fig. 3. The use of dropping resistors between the transformer secondary and the diode will reduce the voltage to required value. Additional filtering is also used.

when R_1 and R_2 are not required, does not exceed 20 volts.

When a higher d.c. output is necessary, the transformer secondary voltage may be greater than 20 volts and a diode such as the 1N39 used in place of the 1N34. The circuit arrangements of Figs. 1A and 1B both result in half-wave rectification of the a.c. supply voltage.

If a smoother d.c. output is desired, full-wave rectification is possible with the circuit of Fig. 2B. The secondary winding is center tapped, and if the voltage between the tap and each end of the secondary winding is not over 20 volts, it is safe to use two 1N34 diodes, and currents ranging up to 100 ma. are available from the circuit. Again, with higher secondary a.c. voltages, a higher voltage rating crystal, like the 1N39, should be put in service.

It can be seen that if the secondary voltage of any available transformer is too high, voltage dropping resistors may be used between the transformer secondary and the diode as in Fig. 1B with their values adjusted so as not to exceed the voltage rating of the crystal in the circuit. However, in the case of the circuit of Fig. 2B, four resistors are required. This is shown in Fig. 3, which also includes additional filtering of the d.c. output.

Although only germanium crystal diodes have been considered thus far in this article, the conventional selenium-type rectifier may be substituted in any of the circuits. Because of the small voltages and currents usually associated with transistor work, the germanium diode is especially suited to this application. Its extra small size also compares with the transistor in miniaturization considerations.

As previously mentioned, it is desirable in experimental transistor work to provide means of varying the output voltage. This is not only a convenience, but to be able to start with zero output and slowly increase the voltage supply is a good protective feature when trying unfamiliar transistor circuits.

The simplest arrangement, probably, is to use a continuously adjustable autotransformer in the 117-volt a.c. supply line. However, these variable controls are often out of reach, pricewise, for many experimenters.

A satisfactory, inexpensive method of obtaining variable output is given in Fig. 4. This arrangement may be applied to any of the previously considered circuits. The sum of the resistive value of the variable control

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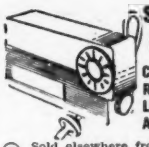

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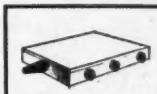

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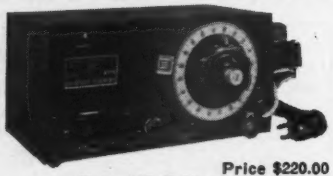

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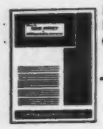

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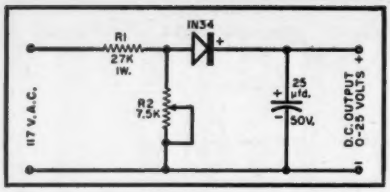


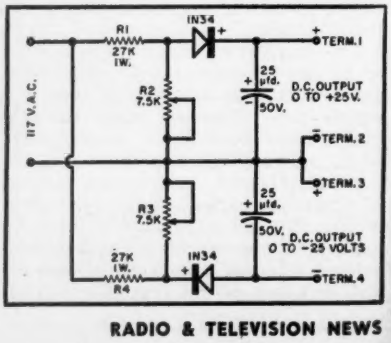
Fig. 4. An inexpensive yet satisfactory method of obtaining variable output. This arrangement can also be applied to other circuits diagrammed and discussed in text.

and the fixed series resistor must be such that the a.c. voltage drop across the variable resistance does not exceed the voltage rating of the crystal diode to be used. The total resistance value of the potentiometer is chosen, as with the fixed resistors, to provide voltages not in excess of the diode rating. As the arm of the control is moved down from its top position, as shown in Fig. 4, the d.c. output voltage increases, reaching a maximum when the arm reaches the bottom, that is, when all the resistance is in the circuit. With the parts values listed, the d.c. output is variable from zero to about 25 volts with a 117-volt a.c. supply.

A circuit arrangement that is useful with experimental transistor circuits requiring two sources of power, such as when utilizing individual emitter and collector circuit supplies, is diagrammed in Fig. 5. It is adaptable to all the foregoing rectifier circuits. Here, the reversed polarities necessary for emitter and collector terminals are available, and individual control is provided for each. As the arm of control, R_2, is varied from top to bottom, increasing the resistance of R_2 across the circuit, the positive potential at terminal #1, say for an emitter, varies from zero to approximately 25 volts. Likewise, as the arm of the variable control, R_3, is moved from bottom to top, the negative potential at terminal #4, suitable for transistor collector, increases. The author used *Clarostat* type 43, 2-watt, wirewound controls.

The experimenter may save himself the sad experience of transistor fatalities during experimentation if he approaches the transistor operating potentials gradually, particularly when operating near maximum ratings. —30—

Fig. 5. A circuit arrangement that is useful in experimental transistor circuit operations. It provides two sources of power to feed the emitter and collector circuits individually, as required by the design.



Key to Color TV

(*Continued from page 55*)

plifiers, color demodulators, and the color synchronization circuits. Inoperative bandpass amplifiers can cause no or weak color reception. If the demodulators should fail, one or more colors may be missing from the color picture. For example, using a color-bar generator, the tube may display a normal bar pattern except that all blue color may be missing. This could be caused by a defective tube or component in the *B-Y* drive to the blue gun of the picture tube.

The color synchronizing circuits can cause two types of defects. If the 3.58 mc. reference oscillator should fail, the picture tube will not display color. If the transmitted burst pulse is not fed to the 3.58 mc. oscillator circuit, possibly due to a defective burst amplifier stage, the color picture information will roll. (This is similar to the effect produced by the absence of horizontal sync in a black-and-white picture.) This condition is illustrated in Fig. 4. It can be seen that red, green, and blue color stripes are running through the picture. By turning the color control off, a normal black-and-white picture may be seen. A wide-band (0-4.5 mc.) oscilloscope is very useful in tracking burst and chrominance signals through the color circuits.

In addition to troubles found only in the color circuits, defects in the i.f. and video stages can cause improper color rendition. For example, it can be seen in Fig. 3 that the edges of the bars are incorrect. This would show as "ringing" in a black-and-white picture. This effect will not vary with adjustment of the fine tuning control. The cause is an open ground in the video delay line which results in improper termination, thus the "ringing" or transient condition.

Fig. 1 includes a photo taken of the face of a color picture tube showing the peacock used at the end of an *NBC* color telecast. This picture illustrates the color display potential of a normal color television receiver using a 3-gun color tube.

As in black-and-white servicing, the picture tube presentation can be a valuable aid in analyzing circuit defects. Loss of color sync resulting in the picture of Fig. 4 would indicate immediately that the trouble was occurring in the color sync circuits. Once the trouble has been mentally analyzed the usual service techniques apply. First check tubes, then check for component failure by taking voltage and resistance readings.

After the technician becomes familiar with color receivers, service becomes almost as routine as black-and-white servicing. Probably the biggest challenge to the technician now entering this new field is the initial installation. However, after he has gained some experience, he will acquire confidence and proficiency.

—30—

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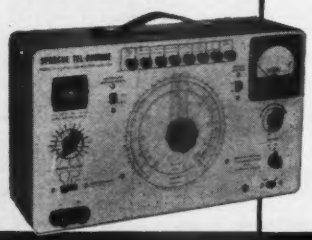

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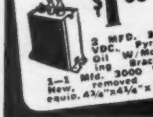

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Analyzers for Missiles and Jet Pilots ..... 76 Dec.
A New Type Circuit Assembly ... 41 Feb.
Bell Labs Designs New V.H.F. Transistor .....124 Apr.
Combat Helmet Two-Way Radio..180 Oct.
Electronic Brain Controls Airborne Guns .....100 Oct.
Electronic "Robot" Copies Code (Smith-Vaniz, Jr.) ..... 85 Feb.
Giant Computer—"Brain" of the SAGE System ..... 43 Sept.
Giant Paraboloid for Scatter Studies .....102 Oct.
"Honeycomb" Signal Storage Tube 140 Oct.
Large Computer Keeps Signal Corps' Records .....118 Nov.
Light Amplification Up to 40,000 Times Now Possible .....105 Apr.
Longest Range Shipborne Radar ..120 Nov.
New Designs in Tube Envelopes... 42 July
New "Plastic" Magnetic Material Developed by Westinghouse ... 77 Sept.
New R.F. Incandescent Lamp .... 87 Apr.
New Transistor Circuits ..... 98 Sept.
Picture-Phone Uses Telephone Lines ..... 43 Nov.
The "Wamoscope"—a Picture Tube That Includes Many Receiver Functions .....105 Nov.
TV Programs on Magnetic Tape .. 92 July
Radar Used for Electronic Surveying ..... 95 Oct.
Radio Astronomers "Tune In" on Venus .....116 Nov.
Red Hot Components for Guided Missiles ..... 45 Dec.

POWER SUPPLIES

Handy Power Supply for Service Shop (Eisner) ..... 56 Apr.
Transistor A.C. Power Supplies (Reed, H.) .....176 Dec.

SHORT-WAVE

Radio Australia Tops with SWL's (Boord) .....112 Apr.

HIGH-FIDELITY-AUDIO

ACOUSTICS

Realistic High Fidelity (Part 1) (Hartley) ..... 39 Apr.
Realistic High Fidelity (Part 2) (Hartley) ..... 46 May
Realistic High Fidelity—Reverberation—How to Organize Your Listening Room (Part 3) (Hartley). 43 June
Room Acoustics for Hi-Fi Listening (Rosenfield) ..... 52 Oct.

AMPLIFIERS

A 50-Watt Power Amplifier (Hafler) ..... 61 June
All Transistor Hi-Fi Amplifier (Lowry) ..... 44 Nov.
A Portable Audio Amplifier System (Buesing) ..... 63 Oct.
A Simple Preamplifier for the Home Builder (Boegli & Willis) ..... 66 Aug.
A Special Purpose Transistor Preamp (Neil) ..... 48 Oct.
A 20-Watt Amplifier System ..... 64 July
5-Watt Transistorized Audio Amplifier (Turner) ..... 53 Apr.
High Fidelity Performance with Mullard's 520 Circuit (Porto) ... 66 Apr.
Hi-Fi Amplifier for Ceramic Cartridges (Mitchell) ..... 58 Dec.
New Hi-Fi Amplifier Uses Printed Circuit (Bach) .....106 Apr.
New Transformer Design for Power Amplifiers (Graham) ..... 72 Nov.
New 25-Watt Power Amplifier (Kramer) ..... 90 Apr.
Transistor Intercom Amplifier (Bohr) ..... 58 May

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Transistorized Audio Amplifier .... 87 Jan.
Simplified Preamp (Sauers) ..... 70 June

CIRCUITS (THEORY)

A Light Bulb Volume Expander—Compressor (Caldwell) ..... 48 Dec.
A Volume Expander for Hi-Fi (Topham) ..... 54 Nov.
Bandpass and Rejection Filters (Sydnor) ..... 148 Nov.
Distortion & Phase-Splitter Unbalance in Push-Pull Amplifiers (Sokal) ..... 142 Nov.
Do You Need a Preamp-Control Unit? (Hines) ..... 47 Jan.
Methods of Measuring and Specifying Audio Distortion (Philbrook).. 68 Aug.
Simplifying Tone Control Circuits (Reed) ..... 112 Mar.
The Additive Tone Control (Rubenstein) ..... 92 Sept.
Tube Types for Audio Use (Knight). 64 Nov.
Tuning Eye or Tuning Meter? (Syrjala) ..... 88 Jan.
Vibrato for Instrument Amplifiers (Libes) ..... 124 Feb.
Voltage Amplifier Distortion (Fleming) ..... 55 Sept.

MISCELLANEOUS

A Home Music System ..... 54 Jan.
An Experimental Hi-Fi System (Kennedy) ..... 60 Dec.
Better Records—A Result of Better Process ..... 74 Jan.
How to Match Hi-Fi Components (Burstein) ..... 68 Sept.
1956 New York Hi-Fi Show ..... 160 Sept.
Our Cover ..... 158 Nov.
Transistorized Intercom (Cleland) ..... 69 Apr.
Transistor-Tube Intercom (Davidson) ..... 108 Feb.
Unusual Sounds Sell Radio "Spots" (Thornton) ..... 67 Feb.

PHONO

Choosing a Phono Pickup (Crowhurst) ..... 37 Jan.
Evolution of the Phonograph (Part 3) (Read & Riley) ..... 58 Jan.
Evolution of the Phonograph (Part 4) (Read & Riley) ..... 54 Feb.
Evolution of the Phonograph (Part 5) (Read & Riley) ..... 64 Mar.
Evolution of the Phonograph (Part 6) (Read & Riley) ..... 72 May
The Ceramic Cartridge and Equalization (Burstein) ..... 43 May
Turntables Versus Record Changers (Crowhurst) ..... 43 Feb.
Your Phonograph Needle (Carter). 88 Apr.

RECORDING

A Professional Tape Recording Amplifier for Home Hi-Fi Systems (Johnson, M.) ..... 71 Dec.
A Tape System You Can Build—A Compatible Tape Deck (Part 1) (MacAllister) ..... 46 Feb.
A Tape System You Can Build—Playback Preamplifier (Part 2) (MacAllister) ..... 49 Mar.
A Tape System You Can Build—The Record-Playback Preamp (Part 3) (MacAllister) ..... 46 Apr.
A Tape System You Can Build—Stereophonic Operation (Part 4) (MacAllister) ..... 56 May
Home Tape Recorders—Planning Your Purchase (Burstein) ..... 39 Mar.
How to Choose a Tape (Welch) .. 58 Nov.
Recording from Tape to Tape with a Single Deck (McRoberts) .... 66 June
Tape Recording—Equalization (Part 5) (Burstein) ..... 66 Jan.
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Timer for 1 Mil Tape (Dorf)..... 170 Dec.

SERVICING

Non-Clipping Wave Squarer (Dorf). 130 Mar.
Servicing Highway Hi-Fi (Roche).. 44 Apr.
Servicing Record Changers (Ecklund) ..... 60 Mar.

SPEAKERS—HOUSINGS

Bass Reflex—Design or Accident (Sanford) ..... 46 July
Buying a Loudspeaker? (Crowhurst) ..... 55 June
Hi-Fi Equipment Cabinets ..... 48 Sept.
Listening Tests for Speakers (Mitchell, J.) ..... 40 Dec.
New Technique for Loudspeaker Loading (Wimpie) ..... 63 Nov.
Realistic High Fidelity—The Single-Cone Loudspeaker (Part 4) (Hartley) ..... 59 July
Realistic High Fidelity—The Dual-Cone Loudspeaker (Part 5) (Hartley) ..... 42 Aug.
Realistic High Fidelity—Multi-channel Speakers (Part 6) (Hartley) ..... 72 Sept.
Realistic High Fidelity—Loud-speaker Baffles and Enclosures (Part 7) (Hartley) ..... 43 Oct.
Realistic High Fidelity—Horn Loud-speakers and Enclosures (Part 8) (Hartley) ..... 51 Nov.
The "Corona Loudspeaker" (Shirley) ..... 57 Oct.
The "Distributed Port" Loudspeaker Enclosure (Petrie) ..... 37 Nov.
Why Do Loudspeakers Sound Different? (Crowhurst) ..... 37 Oct.

STEREOPHONIC

A New Approach to Hi-Fi Stereophonics (Crowhurst) ..... 35 Aug.
An Improved "3D" Converter (Chernof) ..... 56 Jan.
Currently Available RCA Victor Stereophonic Tapes ..... 156 Sept.

TELEVISION

ANTENNAS

Antenna Rotators (Buchsbaum) .. 39 Aug.
New TV Antenna Roundup (Buchsbaum) ..... 62 May
The "G-Line" Community TV System (Gary) ..... 40 Nov.
"The Showman"—A New Indoor TV Antenna (Harris) ..... 54 Sept.
Transmission Lines (Gary) ..... 39 June

MISCELLANEOUS

California Regulates Community TV (Sands) ..... 43 Apr.
Cover Story ..... 79 Dec.
Learn to Service All Color Sets .. 64 Dec.
Manufacturers' Specialized Color Training Programs ..... 63 Dec.
New Call Letter Assignments..... 113 Nov.
New TV Stations on the Air..... 126 Jan.
New TV Stations on the Air..... 152 Feb.
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Satellite TV (Grund) ..... 50 May

NEW DEVELOPMENTS

A New Single-Gun Color Tube .... 62 July
New G-E Color Picture Tube ..... 104 Jan.
New Picture Tubes for 1956 (Buchsbaum) ..... 63 Mar.
New Tube for U.H.F. TV (Mickey, Jr. & Rush) ..... 46 Mar.
New TV Receiving Tubes (Gary) .. 38 Mar.
New TV Tuner ..... 40 Sept.
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Push-button Remote TV Tuning (Sheneman) ..... 94 Dec.

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G. E. CARNEY, Business Manager.

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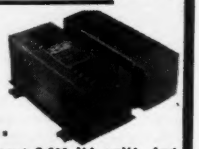

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ERRATA

Stafford E. Davis' call letters on page 192 of the October 1956 issue should have read W5HDM instead of W5HIM, as shown.

• • •

A typographical error in the Precise Development Corp. ad (page 11, October issue) listed the Model 116W tester as $19.95 in factory-wired form. This figure should, of course, be $119.95.

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1X2	.85	6BE6	.45	6SN7	.55	12SK7	.45
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6AC7	.65	6BQ6	.90	6W4	.35	25W4	.45
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6AK5	.60	6C4	.35	6X5	.45	35W4	.50
6AL5	.40	6CB6	.80	6X8	.85	35Z5	.45
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DECEMBER 1956

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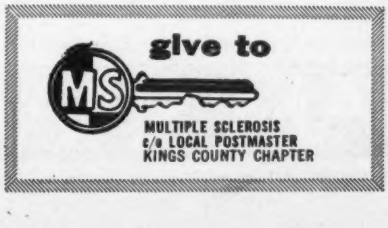

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5AW4	1.10	6CS6	.75	7Y4	.85	50X6	.85
5AZ4	.60	6CU6	1.30	12A6	.57	50Y6	.78
5J6	.90	6D6	.59	12A4	.85	50Y7	.78
5R4GY	1.45	6DC6	.95	12A6	.57	70L7	1.15
5T4	.90	6E5	.75	12A8GT	.79	83	.95
5U4G	.58	6F5	.59	12AH7GT	1.05	83V	.95
5U8	1.10	6F6	.85	12AL5	.65	84/6Z4	.49
5V4G	.88	6F6GT	.69	12AQ5	.70	117L/M7	2.45
5V6GT	.70	6F7	.85	12AT6	.48	117N/P7	2.45
5W4GT	.65	6F8G	.72	12AT7	.92	117Z3	.68
5X4G	.75	6G6G	.72	12AU6	.62	117Z4	1.05
5X8	1.05	6H6	.59	12AU7	.75	117Z6	.95
5Y3GT	.49	6H6GT	.49	12AV6	.52		
5Y4G	.65	6J4	2.55	12AV7	.95		
5Z3	.69	6J5	.48	12AW6	.95		
5Z4	.89	6J5GT	.47	12AX4	.85		
6A3	.95	6J6	.68	12AX7	.78		
6A6	.82	6J7	.82	12AY7	1.15		
6A7	.89	6J7GT	.65	12AZ7	.85		
6A8	1.05	6K6GT	.63	12B4	.85		
6ABGT	.95	6K7	.74	12BA6	.60		
6AB4	.59	6K7GT	.59	12BA7	.89		
6AB7	.95	6K8	1.10	12BD6	.70		
6AC5	1.05	6K8GT	.95	12BE6	.65		
6AC7	.85	6L6	1.69				

TRANSMITTING TUBES

0A3/VR75	.86	5JP2	6.35	876	.72	5687	2.65
0B3/VR90	.73	5JP5	9.95	878	.48	5692	5.10
0C3/VR105	.68	5LP1	7.40	884	.95	5693	4.65
0D3/VR150	.68	5NP1	4.95	885	.95	5696	.90
1B22	1.25	6AC7W	1.45	902	2.45	5702	1.95
1B23	2.68	6AK5W	1.45	918	1.65	5703	.95
1B24	4.85	6AL5W	.95	923	1.25	5704	1.85
1B27	12.95	6AQ5W	1.70	925	1.50	5718	2.75
1B35	3.45	6AS6W	2.69	927	.95	5718A	4.75
1B38	33.50	6BF7W	3.45	930	1.19	5719	2.15
1B40	3.45	6C4W	6.75	931A	2.95	5725	1.45
1B41	3.75	6C21	14.95	954	.25	5726	.60
1C21	1.89	6F4	2.65	955	.35	5727	1.25
1N21	.39	6J4WA	4.45	956	.35	5732	2.95
1N21B	1.45	6J5WGT	3.90	957	.35	5744	1.75
1N23	.68	6J6W	2.20	958A	.35	5751	1.45
1N23B	1.40	6J6WA	3.90	959	1.32	5762	99.50
1N34	.42	6K4	2.20	991	.29	5763	1.25
1N34A	.48	6SN7WGT	1.85	1603	2.95	5783	4.45
1P21	29.50	6X4W	1.20	1616	.50	5787CK	4.05
1P22	13.25	6X5W	1.35	1619	.30	5794	5.95
1P23	1.85	7BP7	4.45	1622	1.45	5812	2.70
1P24	1.45	12DP7	14.95	1624	.95	5814	.95
1P25	64.50	15E	1.45	1625	.29	5819	32.50
1P28	8.95	15R	.49	1626	.19	5820	495.00
1P30	1.95	28D7	.95	1633	.85	5823	1.35
1P32	.95	100TH	6.25	1635	1.48	5829	1.35
1P39	1.45	100TL	8.25	1641	1.35	5840	4.40
1P40	1.25	211	.45	1654	1.75	5841	7.40
1P41	2.45	249B	2.95	2050	1.25	5844	.95
1P42	2.35	249C	1.95	2051	.65	5851	3.45
2AP1	4.95	250TH	18.95	5516	6.45	5876	12.50
2B22	1.95	250TL	14.75	5517	1.65	5879	1.25
2C21	.39	262B	4.95	5634	6.95	5881	2.95
2C34	.25	274A	3.45	5636	2.90	5886	3.25
2C36	21.50	274B	.85	5637	4.95	5894	15.95
2C39A	10.95	304TH	7.95	5638	7.45	5896	4.45
2C40	9.45	304TL	9.95	5639	8.95	5899	3.95
2C43	10.25	307A	1.10	5641	5.95	5902	5.95
2C52	2.95	350A	2.65	5642	.95	5905	8.75
2C53	10.75	350B	2.35	5643	5.95	5906	14.95
2D21	.65	371B	.85	5647	3.95	5908	7.85
2D21W	1.95	393A	4.50	5651	1.35	5932	3.95
2E22	3.15	WL417A	2.95	5654	1.25	5933	2.25
2E24	2.40	417A/5842		5656	7.90	5963	5.45
2E26	3.25		12.45	5670	1.10	6021	4.45
2E30	1.55	434A	2.95	5675	10.95	6080WA	7.95
2G21	2.45	450TH	47.50	5676	1.25	6096	1.45
2J31	14.00	450TL	35.00	5678	1.25	6097	1.45
2J32	12.50	575A	9.95	5686	1.95	6098	1.85
2J33	14.00	705A	.68				
2J34	14.00	707A	4.95				
2J36	14.95	707B	3.95				
2J51	97.50	715B	2.95				
2J55	39.50	715C	10.95				
2J61	12.95	717A	.35				
2J62	12.95	721A	.65				
2K23	15.25	723A/B	8.45				
2K25	11.95	725A	2.95				
2K28	27.50	726A	4.95				
2K33A	56.95	726B	32.50				
3AP1	2.90	726C	32.50				
3B24	.95	750TL	65.00				
3B24W	4.95	801A	.38				
3B25	4.95	802	2.45				
3B26	7.45	803	1.40				
3B27	3.45	804	8.85				
3B29	5.95	805	3.95				
3RP1	2.45	806	4.85				
3C22	59.50	807	1.18				
3C23	3.45	808	1.25				
3C24	1.48	809	2.20				
3C45	5.95	810	10.50				
3D21A	2.95	811	2.75				
3DP1	3.25	811A	3.25				
3E29	9.00	812	2.75				
4-65A	13.25	812A	3.25				
4-125A	18.95	813	10.50				
4-250A	29.50	814	1.95				
4C27	8.95	815	1.95				
4C28	17.45	816	1.15				
4C35	13.45	826	.65				
4E27	7.95	828	7.42				
4X150A	22.45	829B	7.95				
4X150G	31.95	830B	.65				
5BP1	2.35	832	5.75				
5BP4	1.95	832A	7.95				
5C22	27.50	833A	42.50				
5CP1	1.95	836	1.45				
5CP1A	8.45	837	1.25				
5CP7	7.95	838	.69				
5D21	7.45	845	4.85				
5FP7	1.20	851	8.95				
5J29	29.50	860	2.75				
5J30	17.25	861	12.95				
5J33	6.95	866A	1.15				
5JP1	12.45	872A	1.25				

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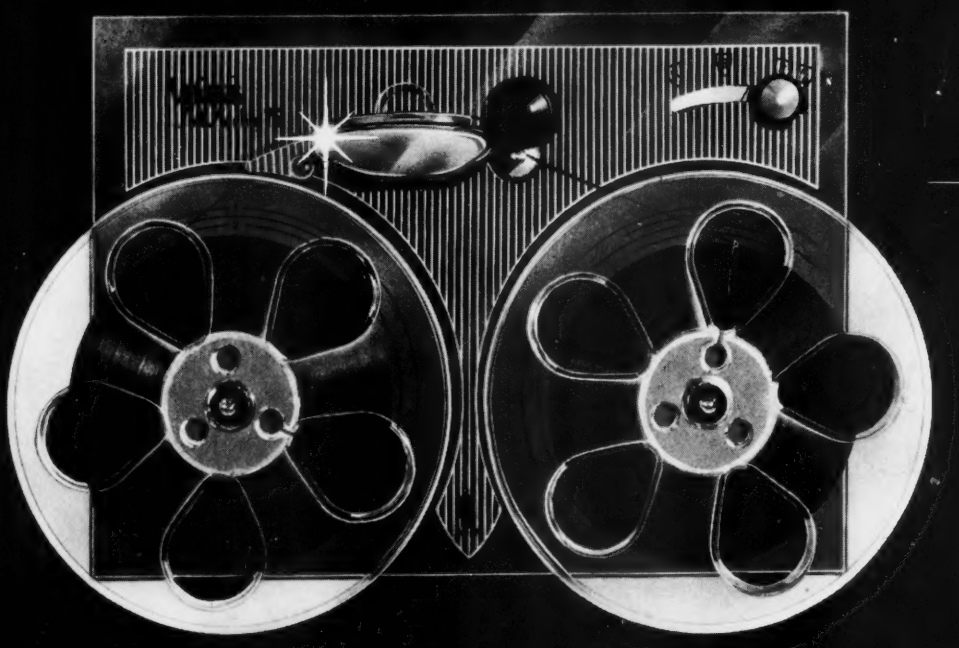

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frequency response, record-playback cycle: 40 to 12,000 cps ± 2 db.

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